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Ball Bearings in the Making

Special Correspondence

Selecting and testing the stock—Rings made by forging and on automatics—Annealing requires six days—Special machines for grinding the rings

THE idea of using a circle of balls upon which to support a revolving shaft, and by converting the rubbing friction of plain bearing surfaces into the rolling friction of balls eliminating the greater part of it altogether, was conceived more than fifty years ago. The first ball bearings were, however, very crude when compared with the modern product and the application of them to moving machinery, especially heavy machinery, was looked upon by the orthodox engineers of that early day as a dubious experiment.

From 1875 to 1880 ball bearings were applied in a tentative way to sewing machines, lawn mowers and other small manually operated mechanisms with the idea of lessening the labor of running them. A few years later the growing popularity of the bicycle as a means of locomotion created the first tangible market of considerable proportions for bearings of low coefficient of friction and directed the attention of engineers to the possibilities to be achieved by the use of steel balls in this manner.

Fig. 1—A Gridley automatic making rings

By 1890 the use of ball bearings in bicycles had become so widely extended that machinery had been devised and companies established to manufacture steel balls in commercial quantities, it being considered that the ball was the only part of the bearing at all difficult to make or exacting in its requirements. The making and assembling of the bearings were largely incidental to the manufacture of the bicycle itself and were carried on in the same shop.

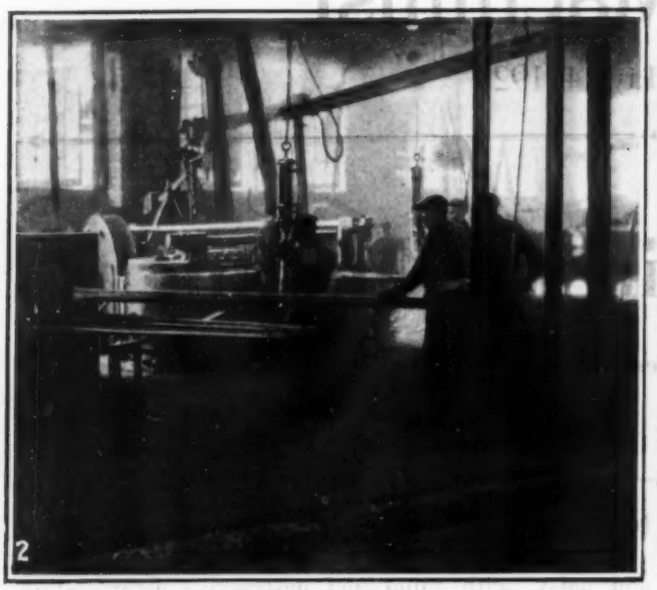
The type of bearing in use at that time was the so-called "cup-and-cone," being neither a radial nor a thrust bearing, but a combination of the principles of both. A dead-weight load on a shaft supported by bearings of this type would cause a severe end thrust that, unless provision was made in the design to sustain it, would soon cause the bearings to become loose and noisy, with rapid and destructive deterioration.

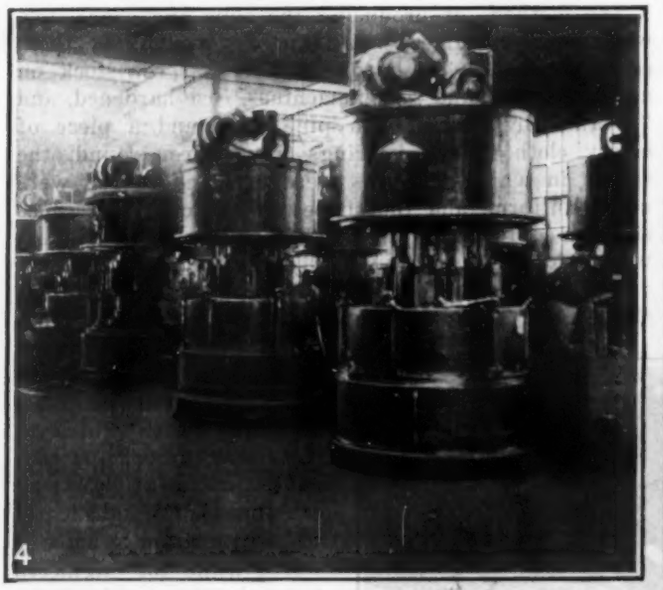
The methods of producing the cups and cones, too, were not conducive to satisfactory results, as these essential parts were made from soft screw-stock on automatics or hand screw-machines, case-hardened, and "ground" by means of a pine stick and a piece of emery cloth. Such bearings were never round, the spaces in which the balls were expected to roll were never uniform, and the shapes of the cups and cones did not conform to that of the balls. Ball retainers were seldom, if ever, used in these bearings.

In order to bring the ball bearing to its present state of perfection and dependability three things were necessary: a uniformly good grade of steel from which to make it; precision machinery with which to make it accurate; and last, but by no means least, an exacting load of sufficiently wide application to make it worth while for engineers to study the problems involved. The first two of these requisites were also demanded by the automobile, and the automobile itself supplied the final need. Thus the development of ball bearings has been contemporaneous with that of the automobile.

While the methods applied to the manufacture of ball bearings are in the main alike, each maker has his own way of going about it to secure the desired results. There must be no seams or soft spots in the materials of which the parts are composed, and no deviation from accuracy of contour of the balls or bearing surfaces. By the use of special machines that have been developed for the purpose it is common everyday practice to produce balls that do not vary more than 0.00005 in. from true sphericity and ball races that are truly round and concentric within a 0.001-in. limit of variation.

One of the early makers of annular ball bearings was the "Ball Bearing Co. of Maine," later moved to





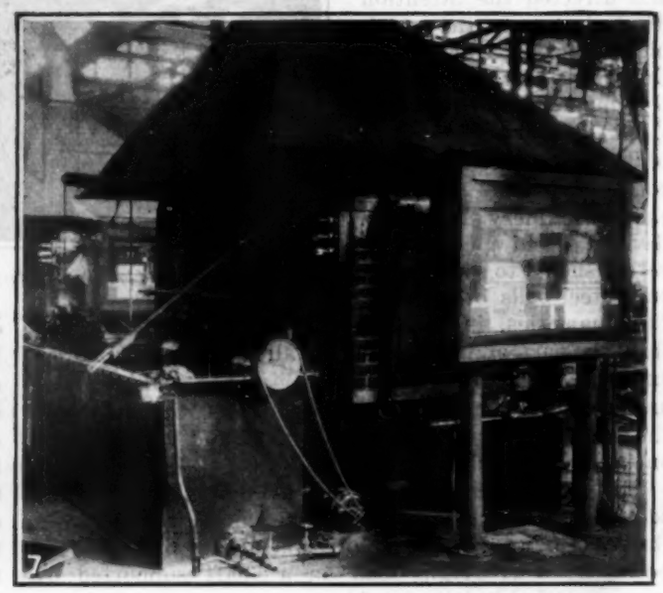


Fig. 2—Forging rings on the Ajax machine. Fig. 3—Loading a car for the annealing furnace. Fig. 4—A battery of Bullard Mult-Au-Matics. Fig. 5—Making ball-race grooves on the Warner & Swasey. Fig. 6—Machining operations on Potter & Johnston. Fig. 7—Hardening furnaces, pyrometers and light signals

Boston where new capital was interested and the name of the Bean City substituted for that of the Pine Tree State. Through channels which it is not our province here to trace, the Ball Bearing Co. of Boston and other smaller manufacturers were eventually boiled down, merged and consolidated into what is now known as Standard Steel and Bearings, Inc., the main plant of which is located at Plainville in Connecticut.

This company, from long association with a single line of work in which it and its antecedents have been continuously engaged since the inception of the industry, has developed many special machines to carry on its work. The photographs with which this article is illustrated were secured in the Plainville factory and the processes described are the ones there carried out. The writer is indebted to the company's engineers for many of the data from which the article is compiled.

High-carbon, chrome-alloy electric-furnace steels are used exclusively at this plant from which to make the parts of its bearings. A disk about ½ in. thick is cut off each end of every bar of steel received, and these disks are subjected to close inspection and rigid tests in the engineering laboratory before the bars from which they are cut are allowed to go into stock.

One Method Used for Large Rings, a Different One for Small Rings

Two methods are employed to convert the bars into rings for ball bearings, depending upon the actual diameter of the parts to be made. For parts not larger than 2 in. in over-all diameter the bars go directly to Cleveland or Gridley automatics, of which both the single and the multi-spindle types are used. Fig. 1 shows a Gridley automatic engaged in the operations of producing a ring. The stock is turned, bored and faced, the corners chamfered and the groove for the ball race formed before the piece is cut off the bar.

Larger rings are forged on Ajax forging machines, one of which may be seen in Fig. 2, and are heat-treated before they go to the machine shop. Each machine is served by two oil-fired furnaces so located that two gangs of men can work together and keep the forging machine in practically continuous operation. Air-hoists, suspended from overhead trolleys, facilitate the handling of heavy bars.

While one gang of men is returning to the furnace a bar from which a ring has just been cut off, the other gang is bringing up a bar from the furnace on the other side of the machine preparatory to forging a ring upon it. The movements of the gangs are so timed that neither has to wait upon the other.

But two strokes of the machine are required to complete a forging. The stock is presented in a position parallel to and before the ram, where it is gripped by the two parts of a separable die that close in from the sides. The first stroke squeezes the plastic metal into the impression of the die, thus forming a head upon the bar corresponding in size and shape to the ring to be made. As the ram recedes from the first blow the dies open, allowing the operatives to transfer the headed bar to the second position in the die. The second advance of the ram pierces the bar out of the head, leaving the completed ring to roll out of the machine when the dies open. The shape and appearance of the bar are not materially altered. It is still a straight, round bar, ready to be presented to the machine to forge a second ring.

From the forging machines the rings go to an open furnace where they are heated to a temperature of 1,650 deg. F. and thrown out upon racks to cool in air. This operation is called "normalizing," and should not be confounded with the annealing, which is the next stage through which the forgings are to pass.

The annealing is done in large car-type furnaces, which are fired with oil and are equipped with recording pyrometers to control the heat. They are ranged along one side of the forge shop and in front of them is a pit in which runs a transfer table of the kind used in railroad yards. From this table a narrow-gage track is laid into each furnace, and, on the opposite side, out into the yards.

A load of rings to be annealed weighs about ten tons, exclusive of the car. As may be seen in Fig. 3 the rings are carefully stacked on the car with each successive tier overlapping the tiers below so that a good circulation is assured and the heat will penetrate uniformly to all parts of the load. As shown in the illustration the car is on the transfer table and when loaded will be run into the open furnace that may be seen just beyond and to the right. The use of the transfer table permits the stacking to be done anywhere within its range that may be convenient.

When a carload of rings has been pushed into the furnace and the doors of the latter sealed, heat is applied at a rate that is calculated to bring the entire load up to a temperature of 1,425 deg. F. in approximately 24 hours, and during the ensuing 24 hours this temperature is maintained without change. The fires are then reduced and the heat allowed to fall at a uniform rate of 10 deg. per hour for the next 20 hours; after which the decrement is increased to 20 deg. per hour until a temperature of 900 deg. is reached. The furnace is then opened and the load allowed to cool in air until the car can be handled comfortably, when it is withdrawn. About six days altogether are required to anneal a load of rings.

The car is then run across the transfer table and out to the tumbling room, where it is unloaded directly into the barrels and the rings tumbled for several hours to remove any scale that may have formed during the forging and annealing operations. In an adjoining room there are a number of specially-built motor-driven face-grinding machines, using annular wheels of 20 grain and very hard grade, on which the rings are "snagged" to remove any fins or irregularities due to the forging dies.

The Machining Process

In the machine shop the rings go to the Bullard "Mult-Au-Matics" shown in Fig. 4, where they are rough-bored, faced on both sides and grooved at a single setting, an operation rendered possible by the use of special chuck jaws and back-facing tools. Both outer and inner rings are handled by the Bullards if the diameter of the work is much over 3 inches.

Inner rings are turned and grooved on Warner & Swasey turret machines, being handled from the bore by pneumatically-operated expanding chucks. Outer rings are finish-bored, turned and faced on Potter & Johnston machines while held in external-jawed pneumatic chucks. Figs. 5 and 6 show these operations respectively. In both cases circular forming tools are used to finish the grooves.

The outer rings are turned to nominal outside diameter (plus grinding allowance) on the Warner & Swasey machines, and during this operation a radius-

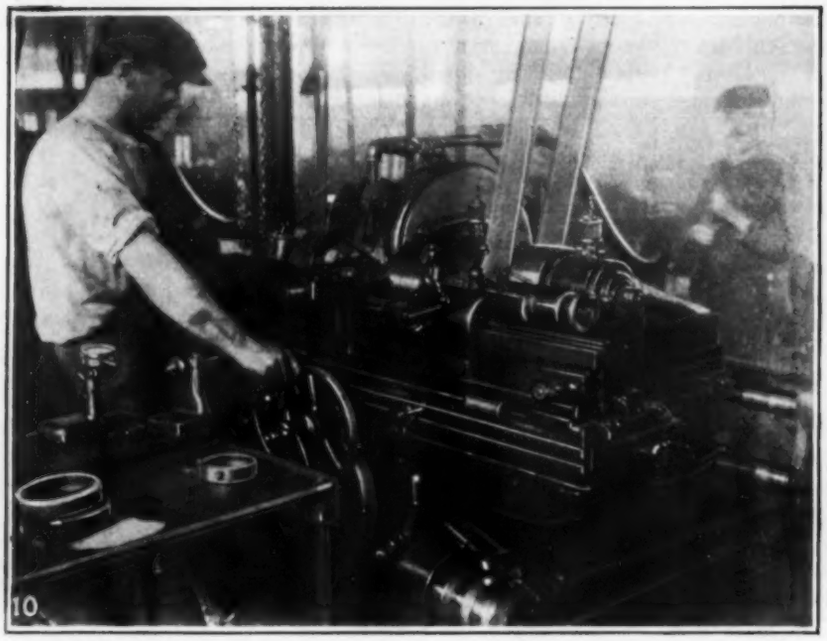
forming tool is applied to round the outer corners of the individual rings.

There remain two minor machining operations to be performed before the rings go to the hardening furnaces. A round-bottomed groove, called the loading slot, is milled in each ring traversely to the ball race groove, and all the rings are stamped with the size, style of bearing and trademark.

The loading slots are milled on Pratt & Whitney hand milling machines with the rings held on a fixture that consists principally of an inclined angle-plate in the face of which is a stud or a recess, depending upon whether it is an inner or an outer ring that is to be milled.

The stamping is done in a punch press in the gate of which all of the stamps necessary to mark several sizes of ring are held at once. The stamps are arranged in concentric circles, three stamps for each size of ring, and the rings are centered upon the die-bed by a set of jaws that close in like the jaws of a universal chuck. There is thus little possibility of error in setting up that will cause a ring to receive a wrong marking.

The hardening is done in oil-fired furnaces that are equipped with Leeds & Northrup recording pyrometers and automatic light signals to enable the operator to control the heats. A group of three electric lamps—red, white and blue in color—is displayed on each furnace in a position where the operator cannot fail to observe the lights as they are lighted by the mechanism of the pyrometers. As long as the heating chamber of the furnace remains at the temperature for which the pyrometers are set the blue light burns. If the heat falls two or three degrees, the blue light goes out



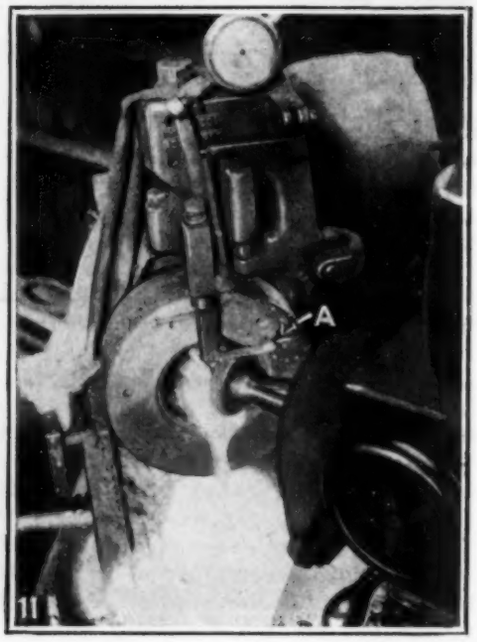


Fig. 8—Face grinding on the Blanchard machine. Fig. 9—Grinding ball-race grooves in inner rings. Fig. 10 Grinding outside diameters. Fig. 11—Sizing device on oscillating grinder

and the white one takes its place. The red light indicates that the furnace is too hot.

One of the hardening furnaces with its accessory apparatus is shown in Fig. 7. There are two chambers in each furnace, each with its pyrometers, heat control, and quenching tank. The rings to be hardened are thrown loosely into the first chamber where they are heated to 1,525 or to 1,600 deg., depending upon the size, and are then quenched cold in oil.

Mechanical circulation is provided to keep the oil in the tank cool, and as the work is drawn out of the furnace it falls into wire baskets in the tank that are kept constantly in motion by a mechanism that is driven by the small motor of the floor.

As soon as the rings are thoroughly cooled from the first heating they are thrown into the second chamber and there heated to 1,425 or to 1,525 deg., depending as before upon the size, and are again quenched cold in the oil tank. They are then transferred to an electrically heated oil bath where they are held for 25 min. at a temperature of 325 deg. to temper them.

After the hardening operation every ring is given a file test, a ringing test—made by dropping it upon a metal plate—and a careful visual inspection. After passing all these tests successfully they go to the Blanchard grinding machine shown in Fig. 8 to be ground on both sides in successive operations.

Inner rings are ground internally upon Heald grinding machines to which are applied special sizing indicators that keep the operator informed as to the exact size of the bore. These sizing indicators have been developed by the engineers of this company, and are applied to nearly all grinding machines and operations.

In each of the sizing devices a diamond is carried upon the end of a lever so suspended that any movement of the diamond will be transmitted to the pointer of a dial indicator located in a position convenient for observation. In all cases the device is made so that the diamond may be swung into or out of contact with the work at the will of the operator.

Automatic Sizing

When the hole that is being ground is brought near to nominal size the operator swings the lever into position to bring the diamond tip in contact with the work. The indicator has already been set so that the pointer will indicate zero when the work reaches the full diameter. The operator has thus but to allow the machine to continue until this condition obtains, when he knows without further trial that the size is right. A plug gage is used later, merely to keep a check upon the sizing device.

The ball race grooves of the inner rings are ground upon standard cylindrical grinding machines with formed wheels, which are fed straight in toward the axis of the work without traverse. The same principle of keeping the size under observation as is used in the preceding operation is applied here. A radius-truing fixture, shown at *A* in Fig. 9, is a part of the equipment of each machine and is brought into action after each 25 pieces of work have been ground. It is always ready for service and the operator has only to traverse the table of the machine to a set stop, which brings the vertical axis of the device opposite the center of the plane of the wheel.

As the size of the work is in this case also read from a sizing indicator attached to the machine, and as the relation between the work and the indicator is not changed by dressing the wheel, the operator can dress the latter as much or as little as he deems necessary to maintain a true radius, knowing that however much he takes off, it is not going to affect the reading of his indicator. Double-row as well as single-row rings are ground in this manner, using for the former two wheels mounted side by side on the arbor and correctly spaced as to center distance. The accuracy of spacing in the latter case is easily maintained, as the operator after bringing the traverse table into contact with its stop to dress the first wheel has only to interpose an accurate size block between the stop and its abutment to locate the truing device in proper relation to the other wheel.

Same Principle in Sizing

Grinding the outside diameter of the outer rings is a very ordinary job of cylindrical grinding, performed as is shown in Fig. 10 by stacking a convenient number of rings on an arbor, securing them with collar and nut and placing the arbor between centers of a Norton or Brown & Sharpe grinding machine. The same principle of continuous indication is employed to maintain the size.

In Fig. 11 is shown the automatic sizing device attached to one of the oscillating grinders used to grind the ball-race grooves in the outer rings. The diamond-carrying lever *A* swings about a vertical axis, and when brought into position to register on the dial the diamond rests in the groove being ground, so that as the diameter of the groove increases the pointer approaches zero. The machine shown by this latter illustration is a special one developed by this company expressly for this work, and is one of a battery of such machines that has been in service for many years. Though giving perfect satisfaction so far as the quality of product is concerned, they have the disadvantage of requiring an operator for each machine, and they are rapidly being superseded by the Van Norman automatic oscillating grinder.

After the grinding operation the races are lapped and polished. For this purpose the rotor shafts of small high-speed electric motors are fitted with arbors and shell chucks, to take the inner and outer rings respectively. The arbors and chucks are made slightly tapering, so that the work may be placed and removed by the operator without stopping the motor.

A lead lap charged with a very fine-grained abrasive is first applied to the revolving rings, followed by a leather-faced burnishing tool saturated with oil. The operation is performed entirely by hand and is very rapid.

The last machining operation is grinding the loading slots to contour gages, for which purpose a special type of grinding machine has been developed in which the spindle is driven by belt from an individual motor in order to secure the very high rotative speeds necessitated by the small-diameter wheels. The table of the machine is inclined at an angle of approximately 45 deg., and upon this table the rings are laid flatwise and guided to the wheel by fixed gages.

Throughout the processes of manufacture the rings are subjected to constant and close inspection, for which purpose many interesting special gages have been devised. The making of balls and the methods of inspecting the parts during the stages of manufacture as well as in the final assembling of them into bearings will be made the subject of a separate article.

Design of a Special Tap for Automatic Feed

By Arthur L. Green

A SPECIAL tap for use on a semi-automatic, vertical nut-tapping machine has been developed by the Buffalo Bolt Co. of North Tonawanda, N. Y. It differs in several essentials from the ordinary tool of this kind. The taps are produced in quantity in the

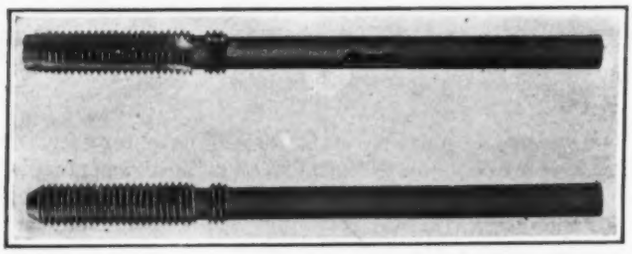


Fig. 1—The special nut-threading tap

company's own machine shop for use with a battery of 42 tapping machines, in sizes varying from ¼ to 2 inches.

The tap, Fig. 1, is placed in the machine pointing vertically upwards and is revolved in a chuck that grips its shank with two alternately operating sets of jaws. The work moves downward and drops off the tap without stoppage of the mechanism.

Illustrated in Fig. 2 is one of these machines in operation. An operator puts the nuts, by hand, into a slide. They feed by gravity down this slide and drop into position over the revolving tap. An automatically-operated fulcrum arm moves down to hold the nut against the tap while the threads are started. The

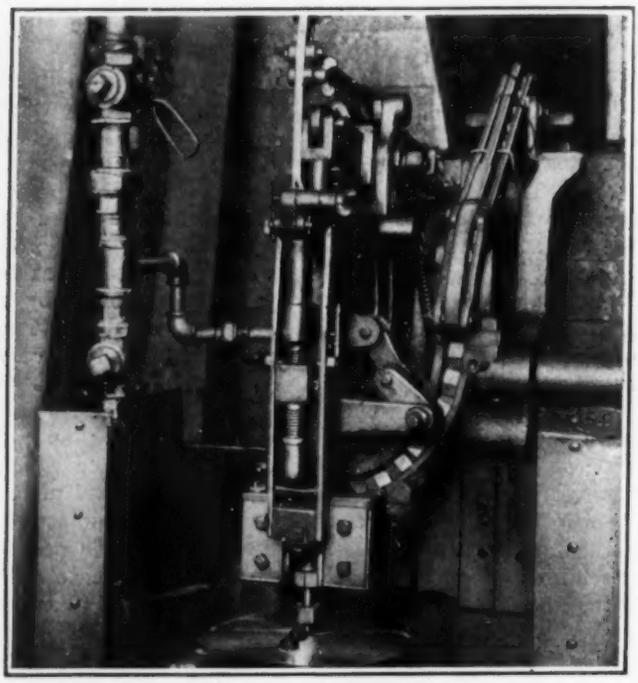


Fig. 2—The tap at work

arm then recedes, and as the nuts drop into position the operation is repeated. The up and down movement of this arm is timed by the operator before tapping begins. The nuts after being tapped drop down the shank of the tap and come to rest on top of the upper set of jaws.

Between the two sets of jaws there is a sufficient amount of space to clear the largest nut that might be run through this particular machine. The jaws are timed in their movement, so that one set is always engaged with the tap while the other is opening and closing. There is a very short period when both are holding. Within the time required to tap each nut, the automatic jaw movements complete a cycle.

When a nut drops on the upper jaws, which are closed, these jaws open and allow it to drop down to the lower set, which will then be engaged and driving the tap. The upper jaws complete the cycle and again close and grip the tap above the nut when the lower ones will open and allow it to drop past them, off the end of the tap, and out of the machine.

The jaws register, grip and drive on two flat spots cut on the shank of the tap. To insure the proper

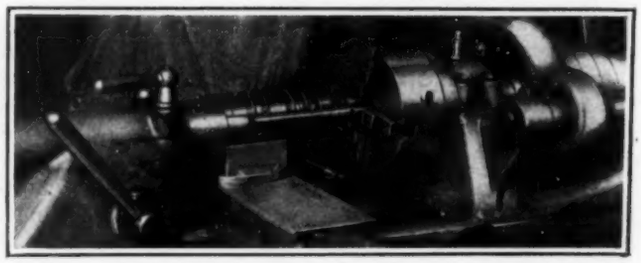


Fig. 3—Marking the shank to locate driving flats

action, a great deal of care is taken to accurately locate and cut these flats.

When the tap has been roughed out, it is held in a lathe chuck, Fig. 3, and rotated. A set of four cutter wheels, properly spaced, are held in a frame that is secured on the lathe cross-slide. These cutter wheels are brought against the shank and made to mark it, as illustrated in Fig. 1, the lower view.

During the course of the operation, the tap is set up as shown in Fig. 4 to cut the flats in the shank on a hand-milling machine. The feed distance for each flat is set before milling operations begin, in order to prevent any variation occurring in the length of the

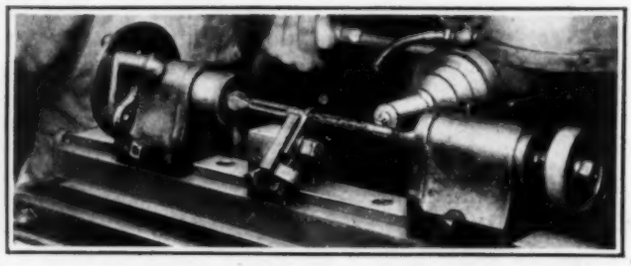


Fig. 4—Milling the driving flats

finished flat or groove. The depth cut is adjusted by scale measurement. The bottom of the end mill is then set on the center line and milling operations are carried forward. All feed controls are by hand.

A complete tap is shown in the upper view, in Fig. 3. The unusual threads that are below the end of the tap proper and spaced a distance from them, together with the slot cut through them, act efficiently as chip-cleaner threads to prevent the chips from clogging. They are cut 0.010 in. smaller than the tapping threads.

More Ton-Miles per Shop-Dollar

By F. M. A'Hearn

Bill Weston has the floor—Behind the scenes in transportation production—Manufacturing methods applied to the railway shop—The departments co-ordinated for service and action and results

JOHN DICK, Bill Weston and Jim Kelly, three regular men, all thorough mechanics, trained together under the able guidance of John Dick, Sr., the founder of the Dick Pump Works. Their early impressions modified or confirmed by years of mechanical experience, each one free in expressing his views on whatever subject may be discussed.

No room for a mental miser in their meetings. No place for the I-know-it-all type of man. Just three good fellows together wherever they chance to meet. John Dick, as the successor of John, Sr. in the Pump Works, with unbounded respect for his two friends, Weston the railway-shop executive, and Kelly the machine-tool dealer.

A successful fishing trip concluded today, tomorrow it will be a matter of history. The three friends are gathered together as the shadows darken. Pipes are alight and solid comfort prevails. An ideal setting for story telling.

"Bill," said Kelly, "you once said, before a meeting of railway-equipment men, that more ton-miles per shop-dollar should be the goal of the railway mechanical man. When I left the meeting that night the words remained in my memory. They are easy to remember, of course, but I have often wondered, Bill, if you realized how much interest you created by that expression.

"I had it printed on our railway-tool catalogues and that phrase has a punch that is hard to dismiss. I have often been asked where the expression originated, and upon telling the source, I invariably get this comment from your acquaintences, well, it sounds like Bill Weston all right. What I would like to know, Bill, is how did you chance upon the expression?"

"Well, Jim," replied Bill, "Let me say that I meant every word of it. We three as apprentices enjoyed certain advantages that are rarely accorded to beginners.

"First, the head of the concern employing us was a thorough mechanic who insisted upon putting his ideals of workmanship into the output of his plant.

"Second, the plant was small and we had the privilege of knowing him personally and receiving our instructions directly from headquarters, not in circular form on the shop bulletin board, nor in the instruction of the foreman or assistant that They wanted this or They wanted that, but from John Dick himself. The mysterious They did not appear in the personnel of the Dick organization. What Mr. Dick said, went, that was all.

"Third, we knew nothing of Capital and Labor. Instead, we learned that so long as Dick pumps could be manufactured and sold at a profit, that long would John Dick have a business and we steady jobs at regular wages. When the business could not be conducted profitably, it must of necessity suspend and we look elsewhere for employment.

"Volumes written today on co-operation, co-ordination of effort, and all of our later-day attempts to bridge the gap between the owner and employee, fall short of the few sentences of this owner-foreman who made it clear to us that our interests were mutual. This did not cover jobs alone, but also municipal affairs. The existence of the Dick Pump Works gave added value to homes and stores in Woodland exactly as big industries affect the general welfare of the state or the nation.

"After Jim and I left the old home shop and secured other work, the force of John Dick's teachings were brought home to me in many ways. The big shops were different from the small one where we were trained. True, a casting was still a casting and a machine tool a machine tool, but there was something lacking.

"When I saw a lathe hand running a cut through the bore of a chuck job, throw out the feed and let the machine cut wind while he rested comfortably on an improvised seat; and when I saw a straw boss trying to make life miserable for one of the gang because their children had quarreled, I did not like the spirit of the place.

"Again, when good material was thrown away to be replaced by new for no reason except indifference on the part of men and manager alike, I resolved that if I were ever placed in a position of authority I would do my best to avoid any of the practices mentioned. Most of my resolutions have worked out fairly well.

"True, we have conditions in railway shops that do not exist elsewhere, and for that reason it is unfair to compare a railway repair shop with, for example, an automobile plant. Occasionally we get an eye opener such as you handed us when you criticised the arrangement of our machine tools. I did not make the original arrangement, I inherited it. Again you jolted me when you showed me the error of allowing the 'home-made complaint' to break out. You got John at the same time

TEN locomotives are in for repairs. Bill Weston and his boys hop to it. Inspection locates the trouble, corrections are made. The ten go back into service.

But wait, there is a great deal more than that. Something else must be built back into the working assembly by the men and the organization and the railway-shop equipment, something—However, let Bill Weston tell what it is; he knows.

too. He is the owner, I am a hired man, so I do not feel the reproach so keenly as I would had conditions been otherwise.

"One noon hour, in the shop where I worked after leaving the Dick Works, the foreman was telling how he had changed certain details of the locomotives. Of course, this was years ago and the place was small, there not being a sufficient engineering force to investigate and authorize changes as we do today, making each a matter of record on the drawings.

"One thought struck me concerning some new parts being applied. Why were the old ones removed? They were not worn out, simply a little difference in the design and construction. Making the engines standard throughout was out of the question as they were of different design and built by different companies. Why the change? The only solution was that the foreman had come from another road and was making the parts as they did where he came from.

"Here was another evil tradition. I did not then, nor do I now think that any of us would make certain changes if they were to be paid for by ourselves. The real owner, that is, the stockholder, and our principal customer, the public, are so remote from the mechanical end that it is possible to overlook them.

Two Things to Sell

"Yes, I could tell you a lot of things concerning shop work that might interest you, but one thing I learned that I will always remember. An old roundhouse foreman told me one day to get an engine ready for a certain run. The job looked big and the time short. I expressed doubts that the job could be completed.

"He said, 'Young man, this little road has to buy almost everything imaginable from real estate to pins, but it has only two things to sell, scrap and transportation. This transportation we sell is our living and we have to hustle to it and deliver the goods.'

"I got to like that roundhouse foreman very much as we became better acquainted. In him I found the closest likeness to John Dick, Sr. that I was ever fortunate enough to know. He ran the roundhouse as if it were his own property.

"Resourceful, prompt in decisions, self-reliant, honest and fair to men and management alike, he was an ideal leader. One thing only he asked of his men, that was their best efforts. Nothing less would answer. He was successful in his private affairs and was quite well to do.

"One evening, as we walked out from the shop together, he said to me, 'Bill, you are young and have excellent opportunities before you. You reflect training received under a master workman. The transportation business of today requires and employs some of the best men that America has produced. The demands upon our transportation systems are increasing yearly, the demands upon the executives are growing in a corresponding manner. Should you choose to remain in railway service you doubtless will sooner or later be holding a position of responsibility.

"'In order that you may measure up to the demands of your job, school yourself to think of your railroad as a unit. By this I mean consider not only the mechanical department, but all departments. Each one must contribute its full share in order to perfect a smoothly working transportation unit. It is easy to believe that, and easy to practice it too, if you are a real man.

"'If you are not a real man, and conduct yourself like a spoiled only child, you may narrow your life down to the point where you will consider your department only, even to the detriment of other departments. After this stage is reached it is but a step further to consider yourself and your own interests, rather than the interests of your employer or the interests of those supervised by you.'"

"What you have told, Bill, is mighty interesting to a manufacturing-shop man, and might cast some light on the reason for so many railroads being in the hands of receivers a few years ago. Still I don't quite get the—more ton-miles per shop-dollar—thought yet," remarked John Dick.

Locomotives are Transportation Tools

"Coming to that point, John," answered Weston, "the idea is this: As the old foreman told me, and allow me to again state that our product is transportation, those locomotives you saw in the shops are not pieces of machinery to sell the same as Kelly's lathes or your mine pumps or roadbuilding machinery. They are merely tools or implements required in the work of transportation.

"Likewise, they are earning money only when they are in revenue service. When they stand idle they are non-productive. When they are in the shop they run up repair bills that must be paid off by the sale of transportation.

"The shop does not manufacture anything to sell, and is useful only in keeping the transportation tools in working order. If our transportation is measured by a unit called a ton-mile, it follows that our production in transportation would be a quantity of ton-miles.

"The question resolves itself to one point. What can the shop man offer to produce more ton-miles per shop-dollar?

The Ton Mile and the Shop Dollar

"The two units, ton-mile and shop-dollar, cover a lot of territory. In the make-up of the ton-mile we have to consider the transportation department, the maintenance of way department, weather conditions, blizzards, tornadoes, rainstorms, and last, but not least, the general public that hires us to transport it and its goods from point to point over our great American railway systems.

"The shop-dollar covers as large a zone, on the other hand, as the ton-mile. We might say it is roughly composed of the three M's, men, material, and machinery.

"In men we have the labor problem. Our business is fairly steady from year to year with no great boom times and comparatively few slumps. However, when general manufacturing conditions are good, you your machine-tool friend Kelly, together with the other manufacturers, make flattering offers to secure help in your plants. As you can regulate the price of your product you are able to offer a more attractive rate of wages during those flush times than the railway shop may offer. To a certain extent, John, you and Jim are competitors in the labor market and, sometimes, your competition is not pleasant to meet.

"Now looking at the second M, material, it will likewise be secured on a competive basis. It would tire you to listen to a recital on even a small per cent of the materials we must have in our pursuit of keeping the tools of transportation in order.

"Delayed deliveries, mis-shipped material, and all of the other annoyances to which you are subject in the

pump works, or which Jim meets in the machine-tool business, are simply multiplied in direct proportion to the greater number of stock items required in locomotive repair work.

"As you have observed in your visits to our shops in Coaltown, some of our machinery, the third M, is quite up-to-date, some of our methods will compare favorably with what may be classed as A-No. 1 shop practice. Certainly we have our weak spots as both you and Jim have pointed out to me. We are trying to improve them. So far as getting from the machinery what it will really produce, I believe that our mechanics in railway shops are above the average.

"You men, both being practical mechanics, will agree that it takes a far more capable man to machine a line of thirty to forty different items on one machine tool than it does to be merely an operator repeating certain pieces week in and week out.

"Even though some of our equipment may not be the last word in the machine builder's art, it is difficult to show that it should be modernized by replacement in the railway shop. On the other hand, in many manufacturing plants it is no problem to show the management that within some certain number of months a new tool will repay the cost of the investment, and make a continued saving thereafter during its service life.

THE railroad has two products to sell, transportation and scrap, according to Bill's friend, the round-house foreman.

Bill knows that the scrap proportion will stay where it belongs depending on the amount of useful transportation he can stop leaking out of, and build back into, each locomotive sent limping home to him.

As he looks at it, the tangible product is scrap but the money that keeps the wolf from his door and the conpany's, all comes from the transportation.

"Having marshalled and reviewed our forces, the three M's, we find that while none of the arrangements are perfect, they are still making a very fair showing. No radical change in the handling of any of them would show a pronounced reduction in the cost of producing our ton-mile. However, we may still go back to the lesson received from my old friend the roundhouse foreman.

"Think of what we railway mechanical men can accomplish by passing over the fact that the mechanical department is a large organization in itself, by considering rather this department as it properly should be considered, a tributary or feeder to the main organization, the transportation machine.

"Fellows, for just a moment imagine that you stand beside me in the mechanical department and look toward the other departments. Now let's see how a careful consideration of their interests and a willingness to pull together toward a desired objective, clears out a space for us to really get out in front and show our stuff."

"Bill," interrupted Jim at this point, "Isn't your line of reasoning a little different from what you and I absorbed when working as mechanics a few years back? If age hasn't dimmed my recollections it seems that a frequently used expression of that day was that railroading is the science of shifting responsibility. Also, that one of the favorite refuges of the railway man of that day when closely pursued for the shortcomings of himself, his gang, or of his department, was called passing the buck."

"Your memory, Jim, serves you correctly," answered Bill, "I will ask you to remember that during that era the attitude of each department was, each for himself and the devil take the hindmost. Let me tell you fellows that the men of that spirit were not producing transportation. Each was ruling his own tiny kingdom in a clumsy, incompetent manner, proving conclusively that were he ever scheduled for a move, it would be back rather than forward.

"I believe I can show where we are bringing out big results in a quiet way. In a manner similarly followed in both of your own shops, we stand behind the product of mine. When the work of re-building a locomotive is completed in our back shop, we do not dismiss it from our minds to wait until it is again delivered to us in a worn out condition. We have placed that locomotive in service after completing our work in a manner calculated to secure the longest possible service term.

"In order to secure this service term, the road foreman of engines, the roundhouse foreman, and the back shop foreman must all work in harmony. Any defective condition due to improper practices in the back shop when discovered by the road foreman receives prompt attention by the roundhouse forces. Aside from correcting the condition, the back shop is in duty bound to trace the trouble to its source and to use the incident as an object lesson to avoid a repetition.

"If it becomes necessary to change manufacturing methods or design, we must set tradition aside and in the interests of progress, make such changes as are necessary to back up our service guarantee. All three departments must keep in close communication with one another during the entire service term of the locomotive. In the roundhouse, close observation may uncover weak spots in the machine, which if neglected, will result in premature removal of the engine from service. The back shop, by keeping in touch with the roundhouse and comparing methods with the condition of the locomotives, after they have been shopped for heavy or classified repairs, may find where some of the roundhouse practices fall short of attaining best results.

"Any student of the art of shifting responsibility, is as popular in our organization as a skunk at a lawn social.

"In addition to turning out a certain number of locomotives in a given period of time, and making the repairs with a certain expenditure in dollars and cents, we are really operating a service department, the object being to keep the locomotive away from the shops in useful duty for the longest reasonable period. Its service period is represented by ton-miles, our efforts in the shop by shop-dollars.

"Any breakdown or failure in service will cause delay to the transportation department that adds to the cost of producing ton-miles. Therefore, you can see that the results of poor workmanship during back-shop repairs are reflected in the sale of transportation.

"John, you and Jim remember old man Brown in his general store back in Woodland, sold boots and shoes, tobacco, ready made clothing, grass seed, farm implements, kerosene oil, horse blankets, ladies' hats, musical

instruments, and any one of the numerous articles needed for the well-being of the community. We in the mechanical department must depend likewise upon our stores department for the supplies needed in the repairs to our equipment. Possibly there is no angle of responsibility worn to a higher polish from frequent handling than that of blaming delays upon the source of supply.

"It requires less effort on the part of any man to wait for the other fellow to secure and deliver to him some certain material, than to exert himself to discover how he may proceed without it. That may seem strange to you, but it is a fact.

"If the stores department must carry an excessive amount of material as a defense or protection against an alleged responsibility for delays to the shop forces, changes in methods or final retirement of some of the locomotives for which that material is intended will eventually lead to scrapping it. Not only does the scrapped material represent almost an entire loss, but each item carried by the stores department must have a storage place. Additional storage means further outlay for additional buildings and adds to the burden of interest upon the investment.

Where the Shoe Pinches

"Of course, all of this talk about idle material, additional buildings and interest on money will have no direct bearing that may appear, for instance, as a part of the labor cost of rebuilding the locomotive, but where the shoe pinches, boys, is this: the money to pay these additional expenses must all come out of the sack stocked by the sale of transportation. Thus you see the expenditure of the shop-dollar involves careful consideration of the affairs of our general stock.

"I believe you can see the absurdity of the shop man alleging a delay due to lack of material when this certain material may only be required at rare intervals, and where its lack is not really important and may be covered by substitution. Observation has convinced me that it takes brains for a mechanical man to forecast his needs with reasonable accuracy in order to give the purchasing department ample time to meet them."

"Bill," said Jim, "I am interested in what you have said and I never realized before that the activities of a railway-shop man could have such far-reaching effects, did you, John?"

"No," answered John, "I didn't. Our manufacturing problem is an entirely different one. As Bill says, we can offset certain increased costs in the selling price of our product. Bill cannot do that. We also allow the jobber to worry about the cost of maintaining warehouses and stocks of material to take care of the wants of the customer. That is his problem. If I want an order of certain materials and ask Jackson for a price and delivery, and find it will be thirty days, and if I then inquire of Brown and find he can do it in ten, Brown gets the order."

"Well," said Jim to Bill, "You have told us about selling transportation, buying material, and the activities of your service department, but you haven't told about the scrap. What becomes of it? How much really serviceable material gets away from your place as such? I have heard more or less, for some years past, about the possibilities of reclaiming materials at railway shops. What has your experience been in that line, Bill?"

"Boys," said Bill, "that is a very important subject, the handling of discarded material. Reclaiming plants have received a good deal of attention, as Jim says, in years past. I would rather talk about that sometime again, but there is one other point that I want to make while I still have your attention.

"My old friend the round-house foreman once illustrated to me just how the movements of his watch corresponded with the operation of a railroad. He told me that when I looked at my watch, my attention was entirely given to the two hands and the dial. While they told me all that I wanted to know, the hour and minute, they were only the outward indexes of a very complicated and accurate machine.

"Now, as I said a while ago, each department of a railroad is of importance. If it were not it would not exist. You men as representatives of the traveling public, or as shippers, usually come in contact with the agent from whom you buy your tickets or make arrangements for the shipment of your freight, or with the conductor who is in charge of your train. Those men are really our sales force.

"The transportation machine is practically the same as a watch. The conductor on the passenger train cannot deliver you to your destination unless there is a good right-of-way to move the cars over. Neither can the cars be moved without the locomotive. Locomotives would be of no use without loaded cars to be hauled. The locomotive department's activities would be cut short without supplies from the stores department. The stores department would have no reason for existence without the demands for its materials from the other departments.

"All departments of a railroad must work together in turning out its product, transportation and, like the watch, if one department is removed the whole machine is useless, and if one department is faulty, the functioning of the machine will suffer. Going direct from the point of supply to the consumer we find that improper handling of the shop-dollar is reflected in the transportation end, and I stick to the statement that the objective of the railway mechanical man must be 'More Ton-Miles per Shop-Dollar,'—Good night, fellows."

"Jim," said John Dick to Kelly after Bill Weston had left them, "What was that scrap-handling or reclamation idea you mentioned to Bill?"

"Well, John," said Jim, "You remember the line that Bill gave you back one time about some of your old machine tools, how he classed them as dry cows and robbers? Bill could not believe that the waste described, represented conditions in the average railway shop, and did not hesitate to say so. It seems that some of his remarks were as gentle as the terms applied to your old machines. I heard that the discussion became mighty interesting before its conclusion. Now, of course, as you have often heard Bill say, the teachings he received from your father stick with him, and as you know better than I can tell you the waste at a shop where the proprietor is in direct charge is going to be mighty small. Bill still insists that material shall be carefully conserved.

"Possibly you have noticed during our visits to Bill's shop that small supplies, such as bolts, rivets, cotters and similar materials usually scattered carelessly about the shop, are conspicuous by their absence. Bill is decidedly 'sot' in his ways regarding careful usage of material, and I have an idea that a monologue by Bill Weston with material handling as a subject, would make mighty interesting entertainment."

Automotive Production

Interchangeable Manufacture As Applied to Airplane Construction

By Wm. B. Stout
Stout Metal Airplane Co.

Details of construction of the ship now being flown by the Ford Motor Co. between Detroit and Chicago—Jigs used throughout—Reasons for using the method described

AIRPLANES have not been with us so long that the practice involved in their construction has solidified into a well-defined form. At the same time, so many of them were put together during the short period of our participation in the World War that the methods employed in the few plants still building wood and fabric planes are substantially the same. As a consequence the structure of the all-metal airplane now being manufactured at the plant of the Stout Metal Airplane Co., Dearborn, Mich., and the methods used in its construction may be of interest as marking a considerable departure from accepted ideas.

In making the plans for what is now a going concern with a well-equipped plant and three successful standardized planes to its credit it was felt that one more airplane company that must depend upon government business or upon subsidies for its support was not an economically sound venture. Enough experience had been accumulated to lead the organizers of this company to believe that the time was ripe to apply automobile manufacturing principles to the airplane. It was decided, therefore, to build one ship and stick to it. If the customer is not satisfied with all the details of the Stout Air Pullman he must take his business elsewhere as no changes will be made in the design. Improvements will naturally be made from time to time as experience and the discovery of new information dictate.

The plane will be made with either wheels or floats, depending on the service in which it is to be used. As a freight vehicle it will be used on airlines, between such manufacturing plants and cities as will guarantee full loads for the season's operation.

In the design of an airplane for commercial service

Fig. 1—The Stout Air Pullman

Span	58 ft. 4 in.	Wing tip clearance	9 ft. 11 in.	Weight empty with water	3,638 lb.
Length (Overall)	45 ft. 8 in.	Horizontal tail area	75 sq.ft.	Useful load	2,379 lb.
Chord Max.	12 ft. 10¾ in.	Vertical tail area	37 sq.ft.	Fuel	4 hr. 100 gal. 600 lb.
Min.	7 ft. 9 in.	Engine Liberty	400 hp.	Oil	72 lb.
Mean.	10 ft. 6¼ in.	Weight per sq.ft.	9.85 lb.	Pilot	160 lb.
Height (at rest)	11 ft. 10 in.	Weight per hp.	14.8 lb.	Pay load	1,547 lb.
Wing area	600 sq.ft.	Total weight	6,017 lb.	Duration at max. speed	4 hr.

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Fig. 2—Stout monoplane in the air

Performance		
Max. speed .....115 m.p.h.	Min. speed .....54 m.p.h.	Absolute ceiling .....12,000 ft.
Cruising speed .....100 m.p.h.	Rate of climb at ground. 500 ft. per min.	Time to service ceiling.....32 min.
	Service ceiling .....10,000 ft.	Time to 5,000 ft.....9½ min.

two factors are of prime importance, safety under all conditions on the ground or in the air and a pay-load capacity sufficient to return a profit on the original investment. A plane on the ground is an expense rather than an asset. Consequently utmost reliability and minimum servicing are indicated. To meet these requirements it was finally decided that the answer was an all-metal, internally-trussed, Liberty-engined monoplane, carrying the maximum load at a cruising speed of 100 m.p.h., or better. The demonstrating plane is shown on the ground in Fig. 1 and in flight in Fig. 2. The arrangement of the seats in the passenger-carrying ship is shown in Fig. 3. These are omitted if the plane is to be used for mail or express and replaced by containers that exactly fit the cabin space.

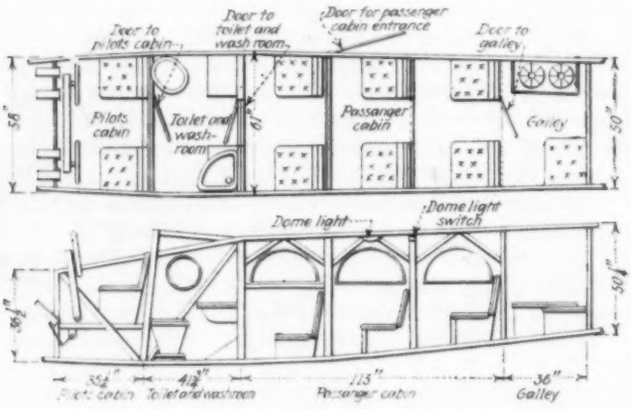
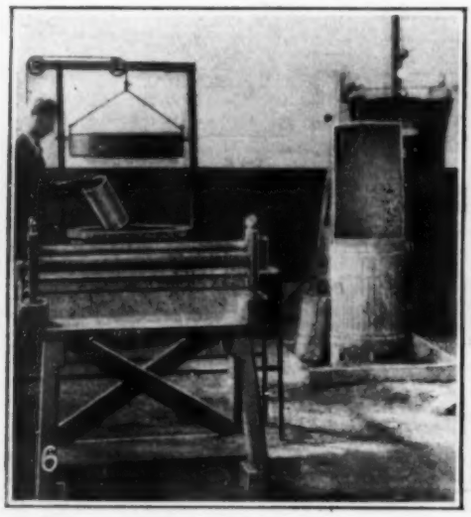


Fig. 3—Seating arrangement

In addition to the characteristics given in the captions it may be said that the various assemblies are readily replaceable when necessary. For the comfort of the passengers the cabin is completely inclosed and the engine is muffled. Gasoline tanks and baggage compartments are in the wings. The split landing-gear adds much to landing safety by doing away with an axle that might catch on brush, heavy weeds or some other obstruction and thus cause the plane to nose over.

The framework of the plane is built up from riveted duralumin structural shapes as is evident from Fig. 4.



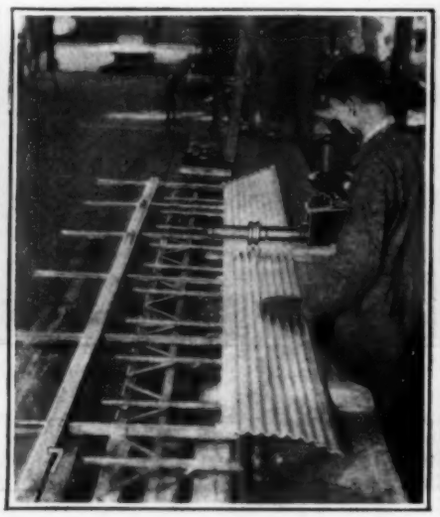


Fig. 6—Heat-treating equipment. Fig. 7—Putting in the corrugations. Fig. 8—The forming rolls

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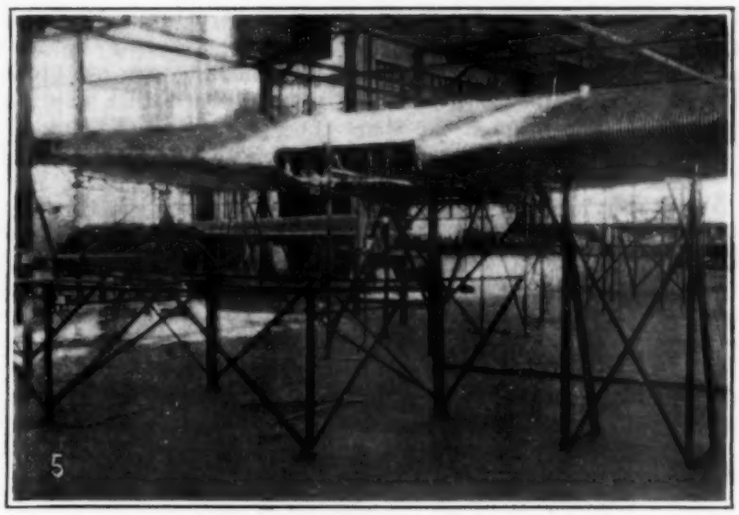

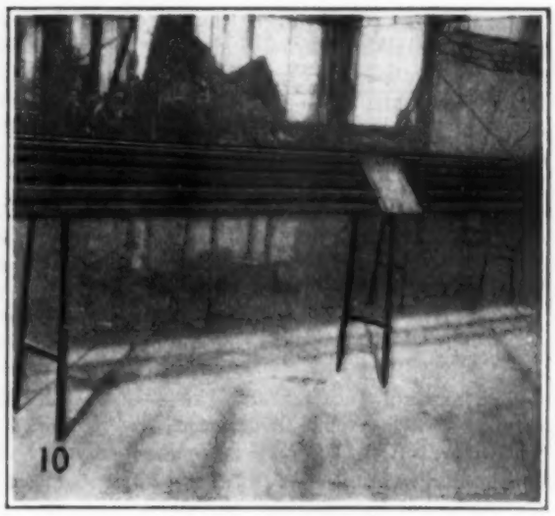

Fig. 5—Wing covering in place. Fig. 10—The form for the leading edge

This view shows the wing spars being assembled on wooden jigs in the old shop. In the new shop jigs made of welded steel angles are used. They can be seen in Fig. 5 which shows the center section of the wing with the corrugated duralumin skin in place.

The corrugation and forming of the thin duralumin skin is no small job in itself. Sheets 16 in. wide and 0.014 in. thick are rolled up as shown in Fig. 6 and heat treated in a pyrometrically controlled lead bath. They

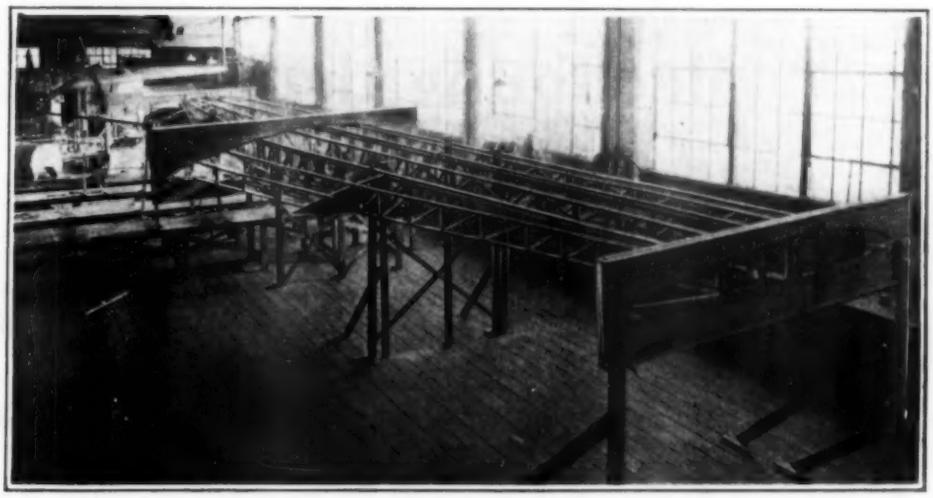

Fig. 4—Assembling the wing structure

Fig. 9—Cutting a piece to shape. Fig. 11—Drilling for skin rivets. Fig. 12—Setting the skin rivets

are then passed through the straightening rolls in the foreground of Fig. 6 and taken to the corrugating rolls illustrated in Fig. 7. Mounted on the carrier shown they are passed between the grooved rolls and one rib is formed at a time. The photograph is a staged one to illustrate the relation between the various parts of the machine.

After being corrugated the pieces are formed to the desired curvature in the bending machine shown in Fig. 8. They are then cut to final size in an ordinary bandsaw as illustrated in Fig. 9. In Fig. 10 a single piece of the leading edge of a wing is shown resting on the form or templet used in shaping up this part of the wing covering.

The method of attaching the skin to the structural members of the wing is illustrated in Figs. 11 and 12. The operator in Fig. 11 is drilling small rivet holes through skin and spar with a portable electric drill. In the other illustration the same man is setting a rivet with a small portable riveter while his helper holds a dolly-bar inside the wing structure. Note the semicircular outer section of the main spar in each illustration. The main wing assembling jigs are fitted with cable-controlled sliding dolly-bars that can be drawn through the spars thus permitting the skin to be riveted fast over the whole length of the spar.

In addition to the jigs shown there are table jigs for making up the framework and for assembling the balanced rudder, the ailerons, the adjustable stabilizer and the other auxiliary surfaces. There is also the main fuselage jig on which this part of the plane is set up.

At the present time Stout monoplanes are being put through the factory in lots of five, but we expect that the rapidly growing interest in inter-city aviation lines will result in enough business to make it possible to increase the number of planes in each lot. When that is the case it may be possible to introduce further refinements in our manufacturing methods. We already have plans for such changes.

Machining the Cleveland-Six Connecting Rod

By M. R. Wells

Research Engineer, Cleveland Automobile Co.

Details of operations and descriptions of the tools used—Rough and finish boring—Milling, and cutting off caps—Tinning and babbitting—Finishing the babbitted holes

THE connecting rods used in the present models of the Cleveland Automobile Co.'s cars, as shown in the illustration, are of the type wherein the piston pin is clamped in the rod and the babbitt is cast into the big end.

The forgings are supposed to be straight and heat-treated before delivery to the machine shop, a coining operation being specified on the hubs until recently. However, the machine shop has found it to advantage to have more metal left at the ends of the hubs for machining purposes, and there is consequently no use in trying to hold the forging to close limits as regards hub length.

The first operation is to rough-bore both pin holes at the same time. During this operation, the rods are clamped at the big ends between two narrow jaws that prevent them from tipping sidewise, but do not prevent the small ends from swinging up or down. The upper jaw is V-shaped and serves to centralize that end of the rod from the outer corners of the hub. At the piston-pin end, the rod rests on a wobble ring that conforms to the end of the hub and the latter is clamped down by three jaws which contact with the outer corners of the hub and serve to locate the entire rod lengthwise and the small end crosswise. It should be noted that this method of holding the rod does *not* submit it to either twisting or bending stresses. Three rods are machined at one time.

In the second operation both ends of both hubs are faced at the same time, in a machine with two vertical spindles. On each spindle is a facing cutter with a pilot that passes through the rough bores of the rod and drives a second facing cutter at the lower or opposite end of the hub. The lower cutters drive through sliding keys from the pilots of the upper cutters, but do not move endwise, being set to give the proper offset between the two ends of the rod. The upper cutters move down together until they reach certain stops, as determined by the hub lengths. By this method, the rod end faces come very close to being parallel and in the proper relation to each other. One rod is handled at a time.

In the third and fourth operations the piston pin hole is finished and broached, working, of course, from the end face of the hub.

In the fifth operation the cap-bolt bosses (to be used later as locating points) are milled at the same time. The rod is located by the two pin holes and clamped between the faces of the big end.

The cap-bolt holes are drilled at the sixth operation.

A paper presented before the Cleveland Section of the Society of Automotive Engineers. April 20th, 1925.

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While four rods are being drilled at one end of the rotating fixture, four others are being removed or loaded at the other. As soon as the drills have entered about ½ in. and are well located, they are raised and the jig plate swung to the loading end of fixture. This makes for less interference from chips as the drilling proceeds and also allows the jig plate to be in position before the next four rods swing under the drills.

In the seventh operation the bolt holes are rough and finish reamed.

In the eighth operation the ends of the cap-bolt bosses are milled off and the cap sawed off at one pass. Two rods are handled at a time, being clamped side by side at the big end and located from the pin hole and bolt bosses. As each rod and cap are removed, the burrs are cleaned off and the cap bolted on before there is any chance of mixing caps.

In the ninth operation the big end or crankpin hole is finish bored while the rod is located from the finished piston-pin hole and the machined cap-bolt bosses. The cut is left rough to provide a better anchorage for the babbitt.

In the tenth operation the hole for the clamp bolt is drilled and tapped, locating, of course, from the pins.

In the eleventh operation the clamping slot for the piston pin is sawed, and the rod is ready for delivery to the assembling floor.

In the twelfth operation the rods are put through the washer and then sent to the babbitting crew.

In the thirteenth operation the caps are removed from the rods and the finished surfaces around the cap-bolt bosses on both cap and rod are coated with a whiting solution or whitewash, to prevent their taking the tinning. They are of course kept in pairs or sets and carefully stacked to dry before tinning.

The caps are next handled by means of a pair of tongs the jaws of which enter the bolt holes. In this way, both parts of the rod are dipped at the same time into the tinning bath (600 deg. F.) for a moment to preheat them before placing them against a slowly rotating bolt arbor or flanged shaft, which is partially immersed in the liquid flux or acid. A brush is sometimes used to assure that the surfaces are being properly coated. The rods are then dipped into the tin bath and agitated while reaching the temperature of the bath, after which they are removed and tapped together to jar off the excess tin, before placing in the Chadwick-Leclair babbitting machine. Right here it might be mentioned that we still find some trouble due to excess tin remaining on the surfaces of the joint between cap and rod, and are therefore intending to install a rotating brush for removing it.

For those not already famiilar with the babbitting machine mentioned, it might be described as a die-casting machine, wherein the hand-operated piston, together with the cylinder for same, is immersed in the bath of melted babbit and pumps the metal up to the dies or molds above. In this case, there are two dies side by side and operating at the same time. The dies are not complete until the rod parts are supplied and automatically held in place by the permanent portions of the dies. The piston is operated by means of a hand lever, with a slow motion that not only fills the die with babbitt (that adheres to the previously tinned rod parts only) but follows up with a supply to care for the shrinkage that occurs as the metal cools. The dies are opened and closed by compressed air controlled by a pedal, thus allowing both hands of the operator to be used in handling the rod parts while the dies are closing. The permanent portions of the dies are kept down to the proper temperature by continuously passing a small amount of water through them. The babbitt pot is heated electrically, and automatically maintained at any predeterimned temperature by a Hoskins temperature regulator.

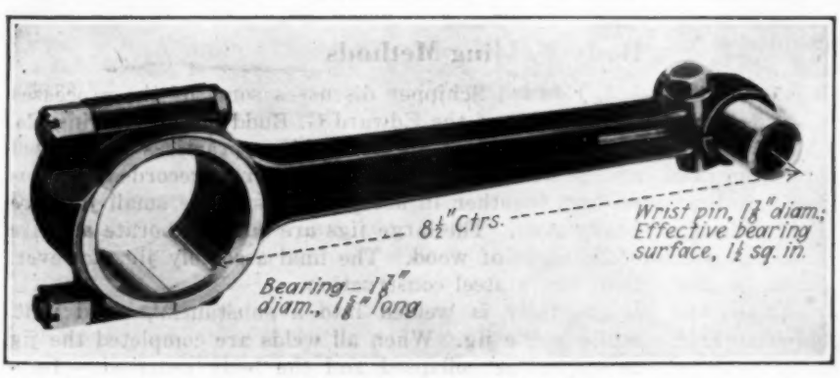
Precautions During Babbitting

It is intended that the surfaces of the joint between the cap and rod shall come into close contact with the corresponding surfaces in the dies, and thus prevent any babbitt reaching these surfaces. If during the tinning operation, too much excess tin remains on these surfaces, it is liable to chill before the parts can make contact, and thus babbitt is deposited over the joint surfaces. This excess not only causes waste of babbitt metal over the entire bearing surface, but also requires considerable extra work when it comes to removing all babbitt from the joint surfaces.

As the rod and cap are removed from the dies, the gate metal comes with them. The rods and caps are stacked together until cooled, when the gates are removed or broken off, and the joint surfaces are filed to remove all babbitt. The caps are then bolted to the rods and they pass to the next operation.

In the fourteenth operation the big ends are finished in a special double-head boring machine. For locating purposes, a piston pin is clamped in the rod and held in V-blocks at the proper distance from the big end. At the same time, the big end is clamped between two V-blocks that grip the cap-bolt bosses. One boring head then feeds them in to rough bore the diameter and face of and chamfer one end. As this head withdraws, the other feeds in from the opposite end, finish reams the diameter, and faces and chamfers the second end.

In the fifteenth operation a combination broach and burnishing bar is pushed through the babbitted bore, serving to give a mirror finish, and at the same time size the bearing to within very close limits. The cap is



Connecting rod of the Cleveland-Six

AUTOMOTIVE PRODUCTION

naturally not as rigid as the rod end, and therefore distorts slightly or springs away as the burnisher goes through. This results in the bore being slightly elliptical, with the long axis across the rod as desired, but this out of roundness is seldom more than one-half thousandth inch. This operation completes the machining of the rods and they then go to be lined up and sorted by weight before assembling.

While it may perhaps be a little premature, the writer feels safe in saying that it will not be long before we are machining the finished rods to such close limits that we will be able to eliminate the straightening or line-up operation. While not yet in production, a slightly different method of holding the rod while finishing the babbitt bearing has been tried out experimentally. On the first attempt, the writer personally operated the feeds to see that they were not too fast, and when the finished rod was inspected it was found to be within 0.0005 in. in 3 in., both as regards twist and squareness.

Method Based on a Wrong Assumption

It may be noted that during the operation of boring the babbitt, as at present, both ends of the rod are held in a manner that does not allow either twisting or bending stresses to relieve themselves. In other words, the clamps at both ends force each end of the rod into a definite position, even if the rod is thereby put under strains. This method was evidently based on the assumption that the cap-bolt bosses, being finished, could be relied upon as locating points. This assumption proved to be a poor one, however, especially when particles of babbitt adhere to the bosses in question.

It would seem safer to locate the rod as regards length, squareness and twist, direct from the piston-pin hole, or in other words, a pin actually clamped in the rod, and then machine the big end while it is gripped securely but in such a manner as will not have any tendency to either bend or twist the rod. V-blocks or jaws do not answer this requirement and the writer therefore proposes to use serrated jaws for gripping the big end, possibly first tightening them sufficiently to imbed themselves for a good grip, and then relieving the tension enough to prevent distortion while the big end is finished. While machining the test rods previously referred to, a smooth-surfaced jaw was used and the writer dared not feed the tools too fast for fear of slipping.

Nearly Perfect Rods Quite Possible

On the assumption that this proposed method gives to the rod a properly lined up, finish-reamed hole with flange faces square with same, the further operation of burnishing without upsetting the alignment does not seem insurmountable. Even at this stage of the process, however, details will have to be worked out so that a broach that is duller on one side than on the other, will not tend to cock in going through. Other similar details may have to be overcome as the work proceeds, but the benefits derived would seem to make it well worth while. Not only would the human element and the cost of lining the rods up by hand, be eliminated, but the finished rod should be free from all internal stresses.

Abstracts

from other publications

Safety Engineering in Automobile Plant

Any man who is seen to be doing an absolutely careless thing in the plant of the Ford Motor Co. is taken off the work immediately and required to spend from an hour to two days, without pay, in the safety office looking at safety pictures. By the time he has finished, the thing uppermost in his mind is safety. Sometimes the only way to impress a certain type of man is through his pocket, and this plan has worked out very well, says E. E. Remington. Many of these men plead to go home so that they can do something while they are off pay, but it is their job to stay in the office looking at the safety pictures, and they do not have a chair to sit on; the pictures are all mounted on the wall.

The company maintains a safety department with a corps of engineers under the direction of the maintenance engineer. The function of the safety engineers is to see that all machinery installed is provided with safety guards to conform with the State law and to give safety instruction to the workmen who operate the machines. The largest percentage of accidents is not caused by lack of safety guards but by the carelessness of the men.

The safety engineer goes to an operator in the machine shop and explains how to perform the operation without danger to himself. But the safety man must first "sell" himself to the superintendent of the department and secure his full co-operation. He must have the support of practically everybody in the plant if he is to accomplish anything. He has the superintendents behind him to a man. If he says that something is feasible to make an operation safer and ought to be done, it is done and nobody can stop him. He can stop any number of machines to make the change. If equipment of any kind is being installed, the safety engineer is always present, and if some safety method is overlooked, he calls attention to it. And if an operator is endangering himself or others by carelessness or awkwardness, the safety man goes directly to him and shows him his fault and then calls the foreman to take note of it.—*S.A.E. Journal*, May.

Body Welding Methods

J. Edward Schipper discusses some of the processes at the plant of the Edward G. Budd Manufacturing Co.

Development of special welding practices has played a large part in the production progress recorded. Pieces are put together in assembly jigs. The small jigs are heavy steel. The large jigs are quite elaborate and are often made of wood. The final assembly jig, however, is of heavy steel construction.

The body is welded into a substantial, rigid unit, while in the jig. When all welds are completed the jig is opened or collapsed and the body removed.—*Automotive Industries*, April 9, p. 652.

Controlling Drawing-Die Pressure with Air-Cushion Cylinders in Conjunction with Automatic Pressure Control

By John Nelson
Marquette Tool & Manufacturing Co.

A method that provides complete control of the blank—Makes a single-acting press double acting and a double-acting press triple acting

ACCORDING to those who have had long and varied experience in drawing sheet metal, the main factor in deep drawing is to control the pressure on the blank while it is being drawn. Generally speaking, too little pressure allows the sheet to wrinkle, while too much pressure stretches the blank beyond the breaking point and it cracks. In addition to having the correct pressure, it is, of course, necessary to know how much to draw the metal at each stroke and the best shapes it should take as it changes from the flat to the finished shape.

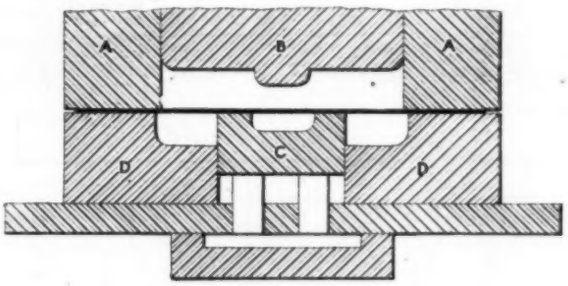


Fig. 1—Section of double-crown die

In order to control the pressure, and also to time the travel of the draw ring, blank holder or other moving parts, the Marquette pressure controls have been devised to act automatically by compressed air, in drawing or forming operations on single- or double-acting presses. By this method one or more parts can be controlled at will, depending on the mechanism employed.

A simple application is shown in Fig. 1, this being a section of a die for a fender having a double crown. With the blank in position, the blank holder or pressure ring *A* descends and holds the sheet against *D*. Then the upper die *B* descends and forms the upper crown between it and the pad *C*, which is held up yieldingly by an air-cushion cylinder beneath. After the small crown has been formed, with the sheet gripped between *B* and *C*, the descending punch *B* forces *C* on down against the action of the cushion, and the main crown is finished when *B* and *C* bottom against the press platen and the dies *D*, respectively. On this down stroke, the pressure may be relieved or not after the center crown is formed, depending on the curvature of the part in the other direction and the tendency to pull metal from the middle rather than from the sides. At the bottom, the upward pressure on *C* is neutralized and it remains down until the punch and blank holder have almost reached the top of their strokes. It then returns to its upper position with the top level with, or a little above, the dies.

Another example shown in Fig. 2, is a wheel housing for an automobile body, made in one operation on a double-acting press. The part presents a large surface and a fairly deep draw, while smoothness and freedom from wrinkles is an essential requirement. The punches and dies are shown in Fig. 3, together with other details.

The blank is placed on top of the draw rings *D*, *D*, and the blank holder *A*, *A*, descends and grips the blank.

The draw rings *D*, *D*, are held in position by rods resting on the pressure pad *E*, which in turn is supported by the cushion cylinders below. With full air pressure in the cylinders, the blank holder *A*, *A*, descends and pulls the blank down over the convex portion of the die *C*, as shown by the dotted lines, giving it a combined stretching and drawing that sets the metal

Fig. 2—Wheel housing for automobile body

so that it will retain its shape instead of springing back or distorting after the other bending and forming has been done.

At this point, the air pressure in the cushion cylinders is automatically reduced to the proper amount so that the draw may be completed without tearing the sheet, or without letting the blank slip. Then the punch

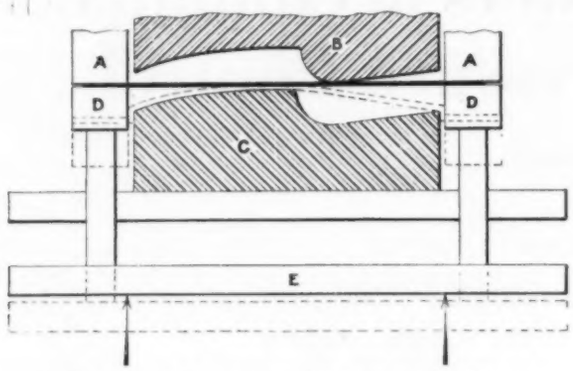


Fig. 3—Putting the "bulge" in the sheet

B is forced down by the ram of the press and forms the space for the wheel, drawing the metal in from that side of the sheet. In Fig. 4, a plan view of the sheet is shown.

Other applications are shown in Figs. 5, 6 and 7. In Fig. 5, a channel is formed in a single-action press

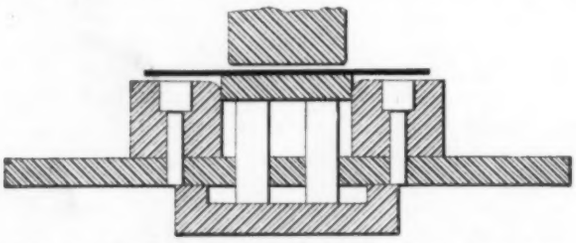


Fig. 5—Forming channel in single-acting press

by using the cushioning cylinders to hold the blank against the bottom of the punch until the depth drawn is about four times the thickness of the metal. Holding to this point prevents the metal from sliding or bulging, so that the channel will keep its shape, and also prevents the blank from slipping to one side; then the air pressure may be reduced or eliminated to save power. After forming, and after the punch has left the channel, the air-cushion cylinders act as an ejector. The ejection can usually be timed so as to allow removal of the

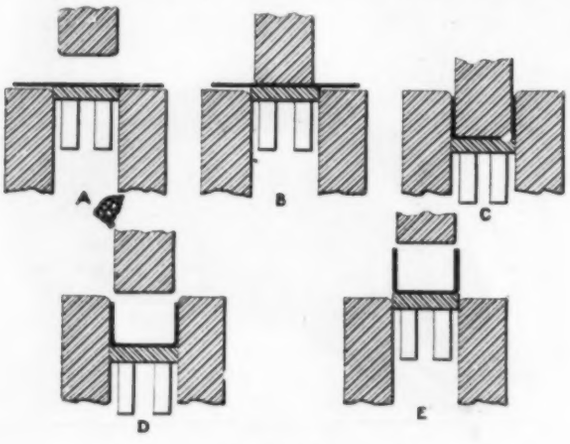


Fig. 6—Cycle of operations

channel and feeding in of the next blank without stopping the press. Fig. 6 shows the cycle of operations.

"Bulging" or curving an automobile door slightly, and drawing the sides, is done in one operation on a single-acting press by the dies shown in Fig. 7. The blank rests on the draw ring *C, C*, the die *A* being

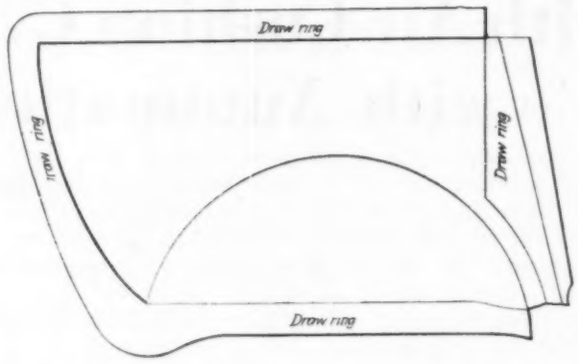


Fig. 4—Details of dies and cushion cylinders

fastened to the ram of the press. As *A* descends it grips the blank between itself and the draw ring *C*, the latter being supported by the cushion cylinders through the pressure pad *D*. It requires a heavy pressure to stretch the sheet for setting the "bulge" but as soon as this is formed, the pressure is automatically

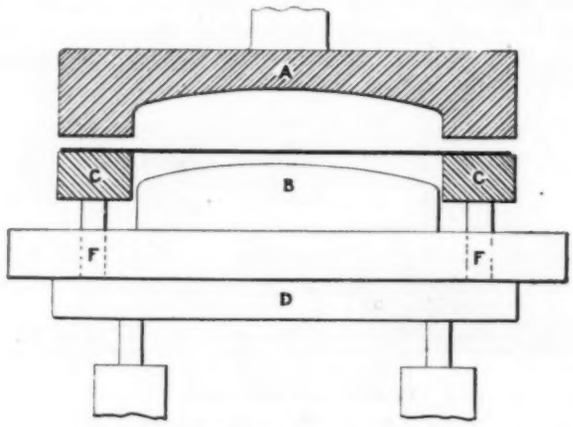


Fig. 7—Drawing a "bulge" in a door

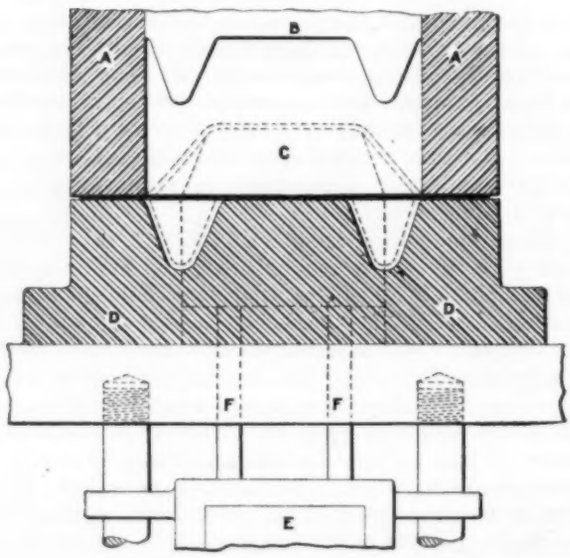


Fig. 8—Details of a clutch disk

reduced to allow the metal to be drawn in around the edge of the sheet without tearing.

A double-acting press job is shown in Fig. 8, the pieces being a cone-clutch disk. The sheet is gripped by the draw ring *A*, *A*, and the central plunger *C*, forced up by the air cylinders beneath, bulges the blank upward as shown by the dotted lines, and takes up metal enough for the forming that follows, so that no

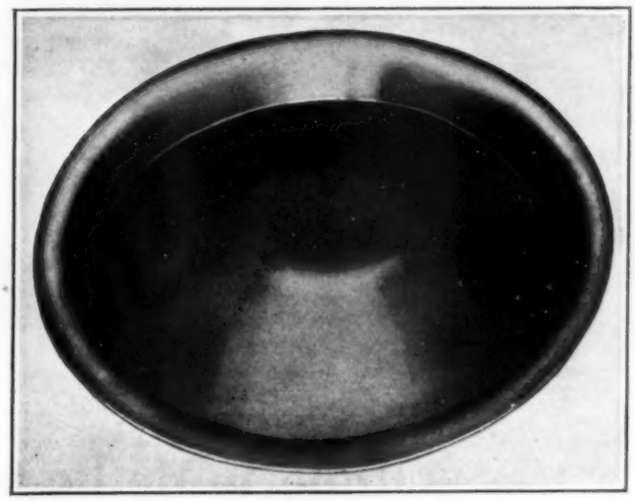


Fig. 9—The finished clutch disk

further stretching is necessary. The punch *B* then descends, forces the metal against the coned sides of *C* and downward, making the finished piece of which Fig. 9 is an illustration.

The method of automatically controlling the air pressure in the cushioning cylinder is of special importance, since it provides a means of increasing, decreasing or

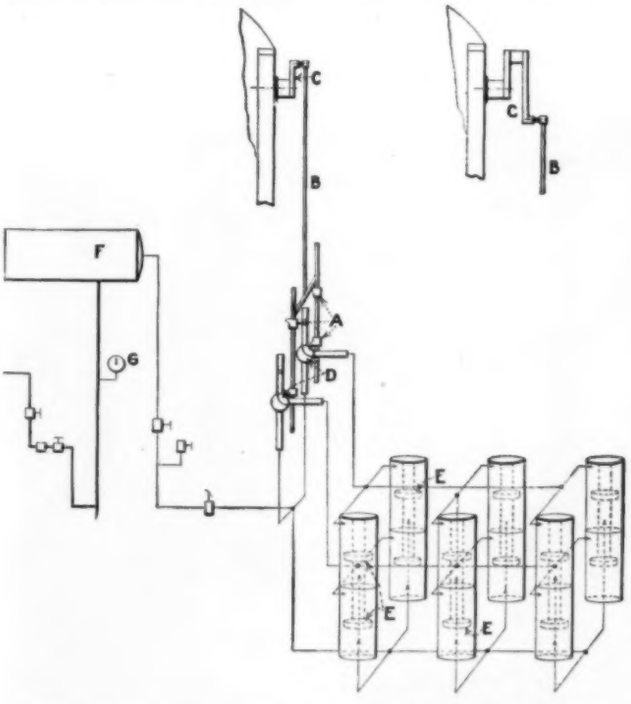


Fig. 10—Diagram of the controlling mechanism

eliminating the pressure as required to suit the work to be done.

Briefly the control is accomplished by using two or more three-way valves, according to the work in hand, the valves being opened or closed at just the desired time by means of adjustable fingers *A*, Fig. 10, on a crosshead that is driven by the crankshaft through the rod *B*. The movement of this crosshead can be adjusted both as to stroke and with relation to the angularity of the cranks *C*. By properly adjusting the crankarm, the length of stroke and the fingers, the valves *D* are opened and closed at the correct time to secure the desired pressure at all stages. The details show the battery of air cushions as at *E*, the air tank *F* and the gage *G*.

The air pressure from the main system is generally about 80 lb. per sq.in., and sub tanks provided with reducing valves are employed to supply the required pressure. Air pressure is constantly supplied to the under side of the piston. When a reduced pressure is desired, the three-way valve admits air to top side of the piston. To again apply pressure, the air above the piston is exhausted.

Pressure may be changed by neutralizing part of the cushions, or by reducing or increasing the pressure of all or of part of the cushions, or by a combination of both methods. Methods have been carefully worked out for economizing air wherever possible. The equipment is built by the Marquette Tool & Manufacturing Co., Chicago, Ill., and the applications shown are only a few of those that have been worked out to meet the varying conditions presented.

Ages of Employees

By John A. Cook

I have found some very helpful information in the *American Machinist*, consequently I look each issue through even to the advertisements.

A recent issue had something to say about employing boys under the ages specified by the laws relating to such matters.

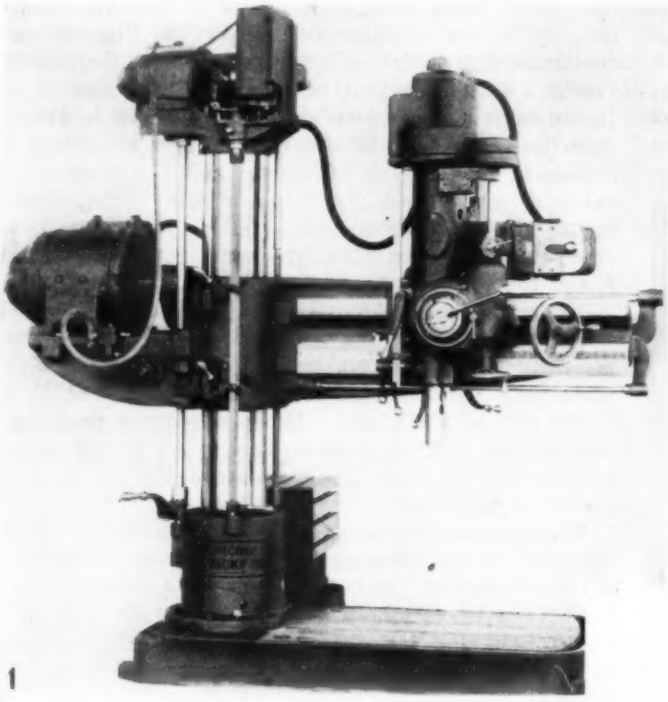
If a boy is employed under the proper age, a false affidavit does not make him of age, neither does a permit from some official change his actual age, hence if the boy is employed contrary to law, the employer is the only one liable and many reliable insurance companies will refuse to have anything to do with a claim for disability, if one arises.

What then may an employer do?

He can make inquiry of the attorney general of his state, or of the department of labor, as to what will be accepted in law as proof of age, and keep the letter of inquiry and the reply in his safe with his insurance policies. His own attorney's opinion is only an opinion and may not be sufficient, so it is best to get this information from the proper state official.

He may learn that a letter from the county clerk giving a copy of the birth record of the boy will be accepted as proof, or that a letter from his priest or minister giving a copy of the church record will be considered proof, or that a copy of the school record furnished by the principal of a school will do. The information the employer needs is obtainable and he should secure it in writing, if he is employing anyone whose age may come in question.

It did not take many years in the manufacturing business to discover that it does not pay "to take a chance" on this matter or any other. "Better be sure than sorry."



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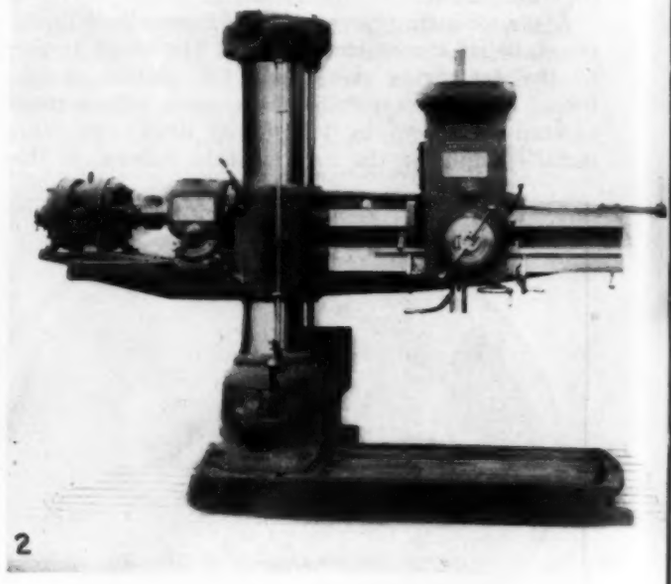

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Modern Methods of M

1—Cincinnati-Bickford 2-motor radial

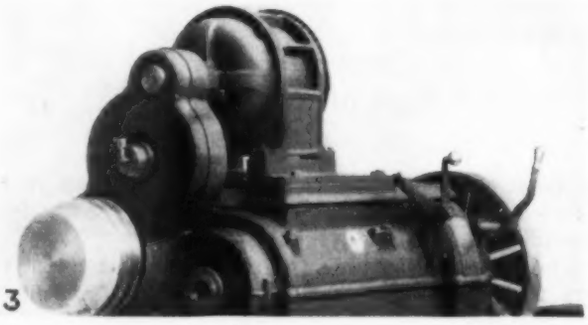
2—American Tool Works radial

3—LeBlond lathe, motor on head

4—Sunstrand toolroom lathe

5—Cincinnati-Bickford high-power vertical

6—LeBlond 2-motor toolroom grinder



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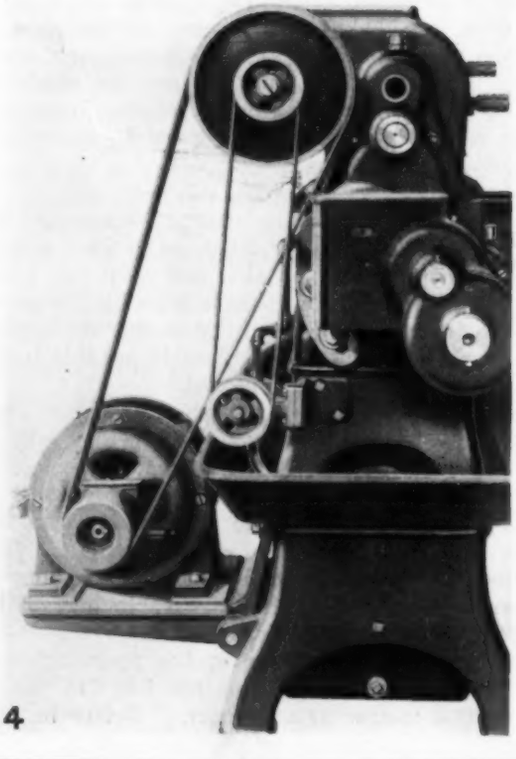

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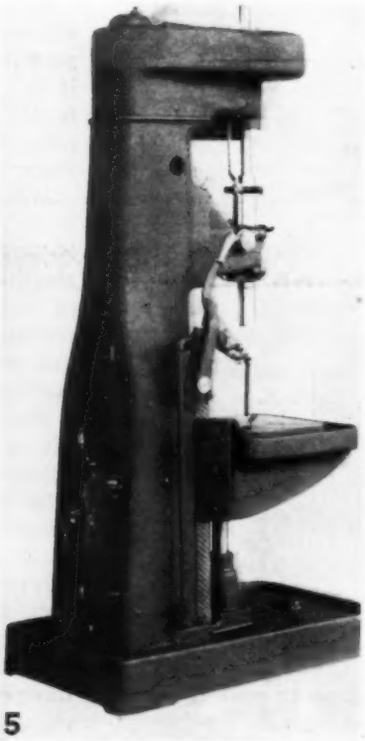

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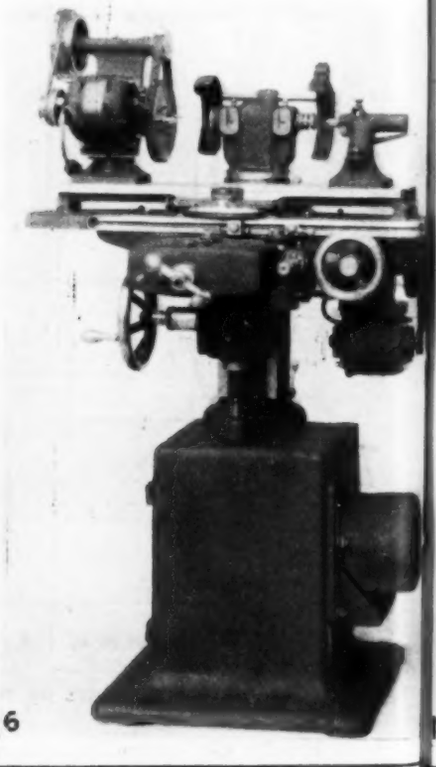

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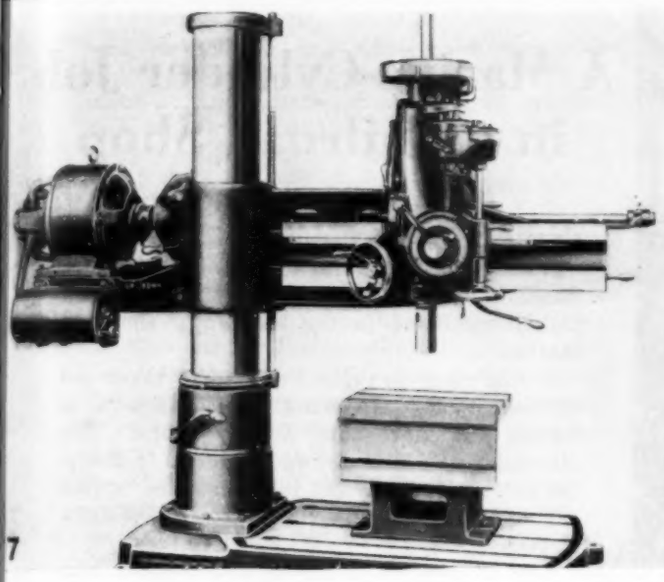

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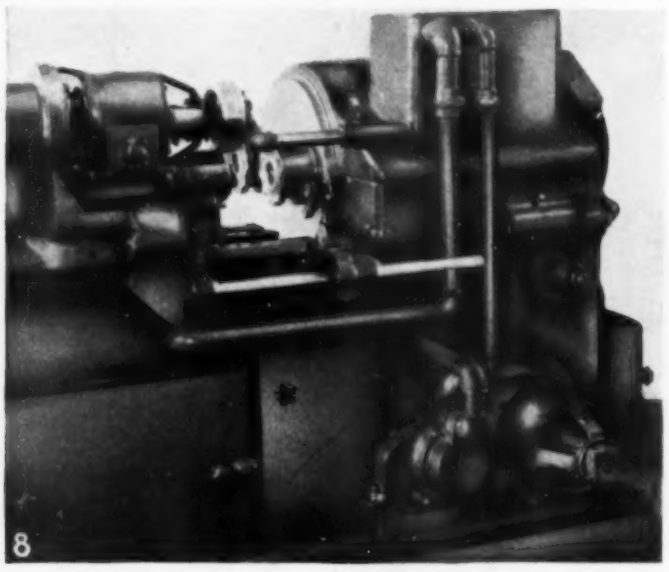

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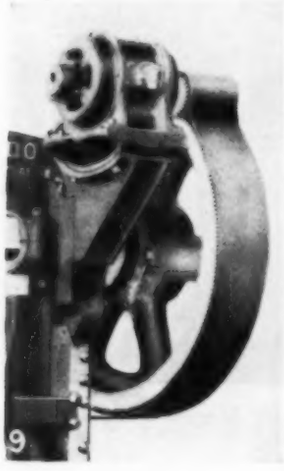
Mounting Motors

7—Morris Machine Tool Co. radial
8—Pratt & Whitney thread hobber
9—Toledo motor-driven press
10—Reed-Prentice production lathe
11—Gleason 25-in. special gear generator
12—LeBlond engine-lathe drive



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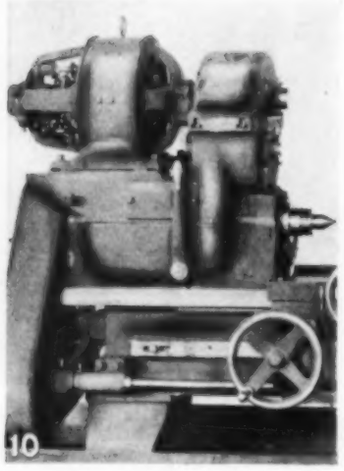

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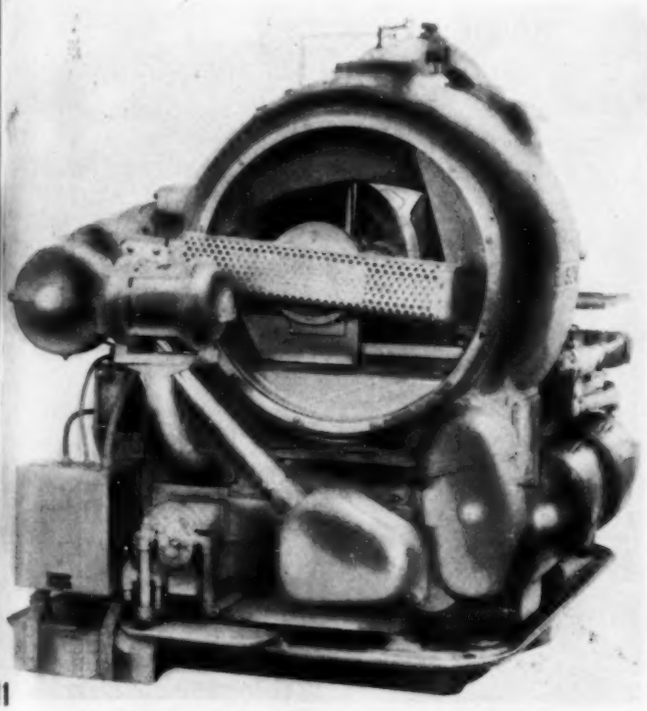

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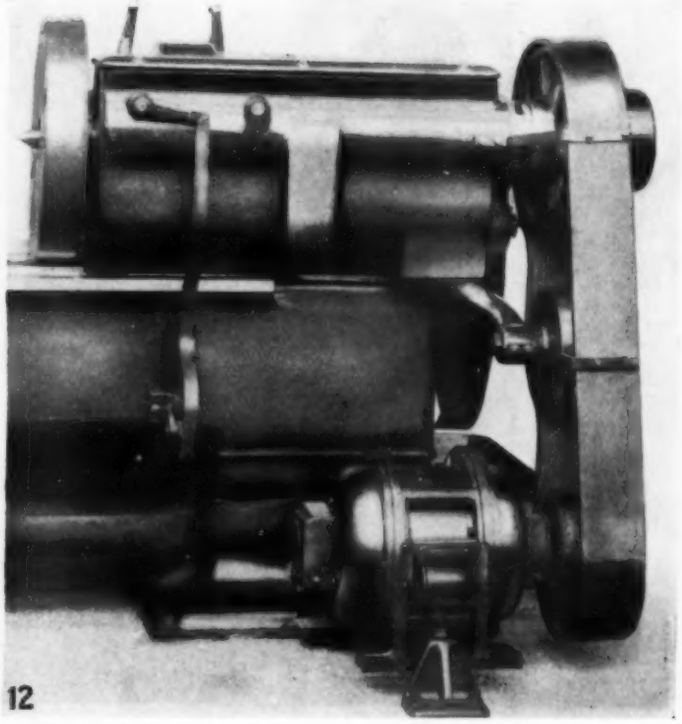

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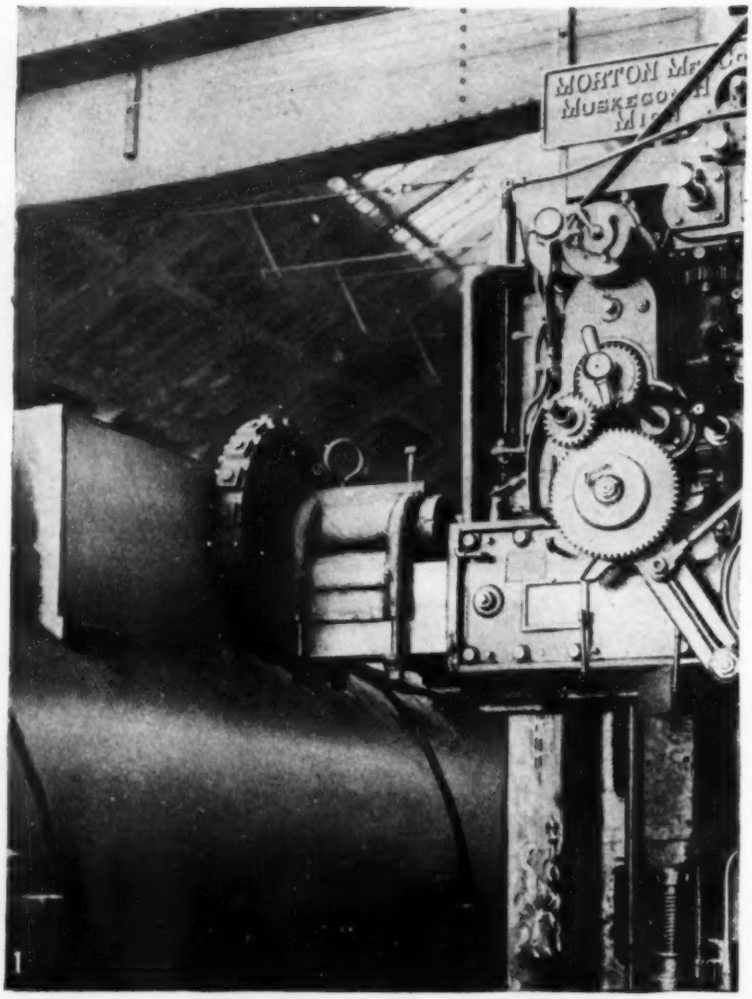

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A Marine-Cylinder Job in a Railroad Shop

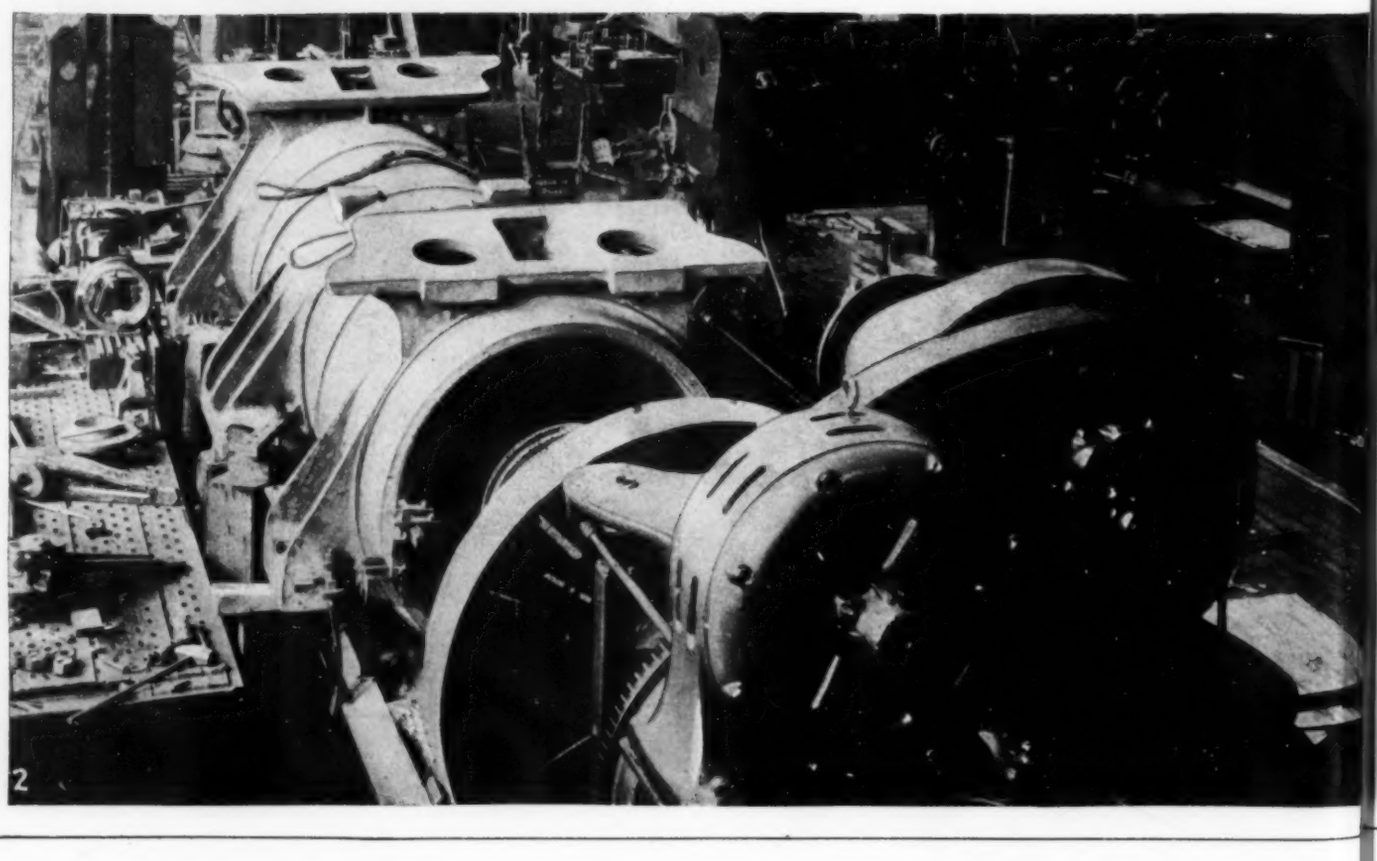
By Frank A. Stanley

THE cylinder shown in the illustrations was cast in the foundry of the Southern Pacific Co., at Sacramento, Calif., and completely machined in the company's shops at that place.

It was made to replace a cylinder taken out of the steamer "Piedmont" that had been in service for more than twenty years. The dimensions of the cylinder are as follows: Diameter of bore, 57 in.; diameter across flanges, 66 in.; length, 17 ft. 10 in. Weight, 21 tons.

The surfaces of the pads and holding lugs were machined on a Morton draw-cut shaper, most of the work being done by the use of the milling attachment forming a part of the machine's equipment. The milling operations are shown in the first and last illustrations, Figs. 1 and 4. Here the cylinder is blocked up with its axis at a right angle to the ram of the shaper, upon which is mounted a large, inserted-tooth milling cutter. The cutter is fed past the work by traversing the column of the machine along the bed.

The two views illustrate the milling cutter in action on the faces of the upper and lower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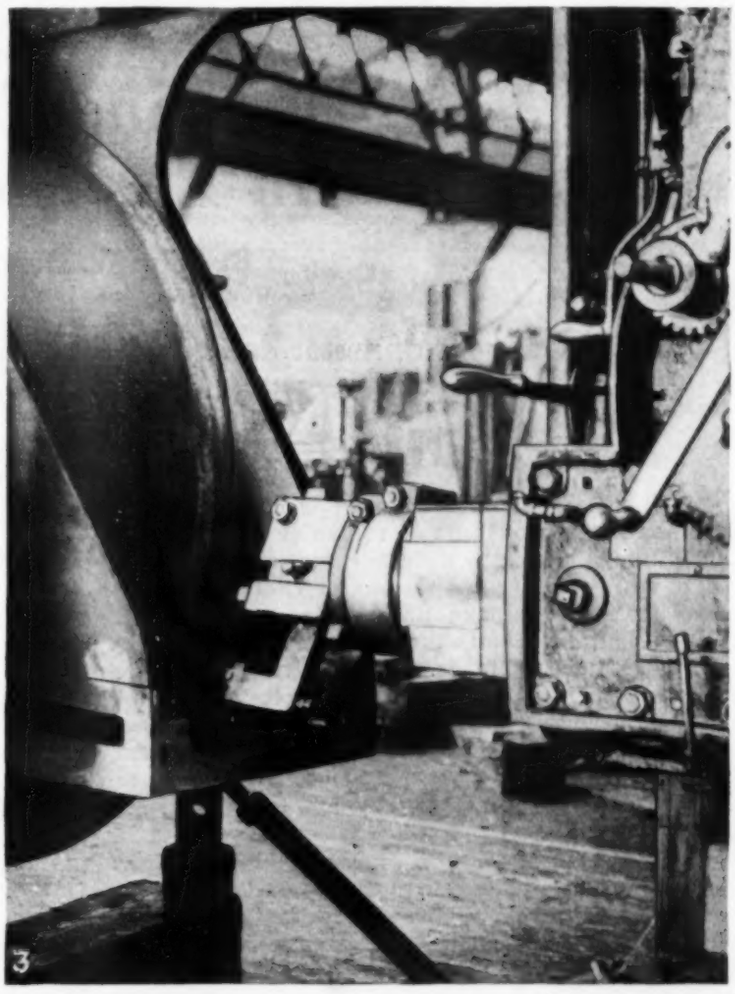
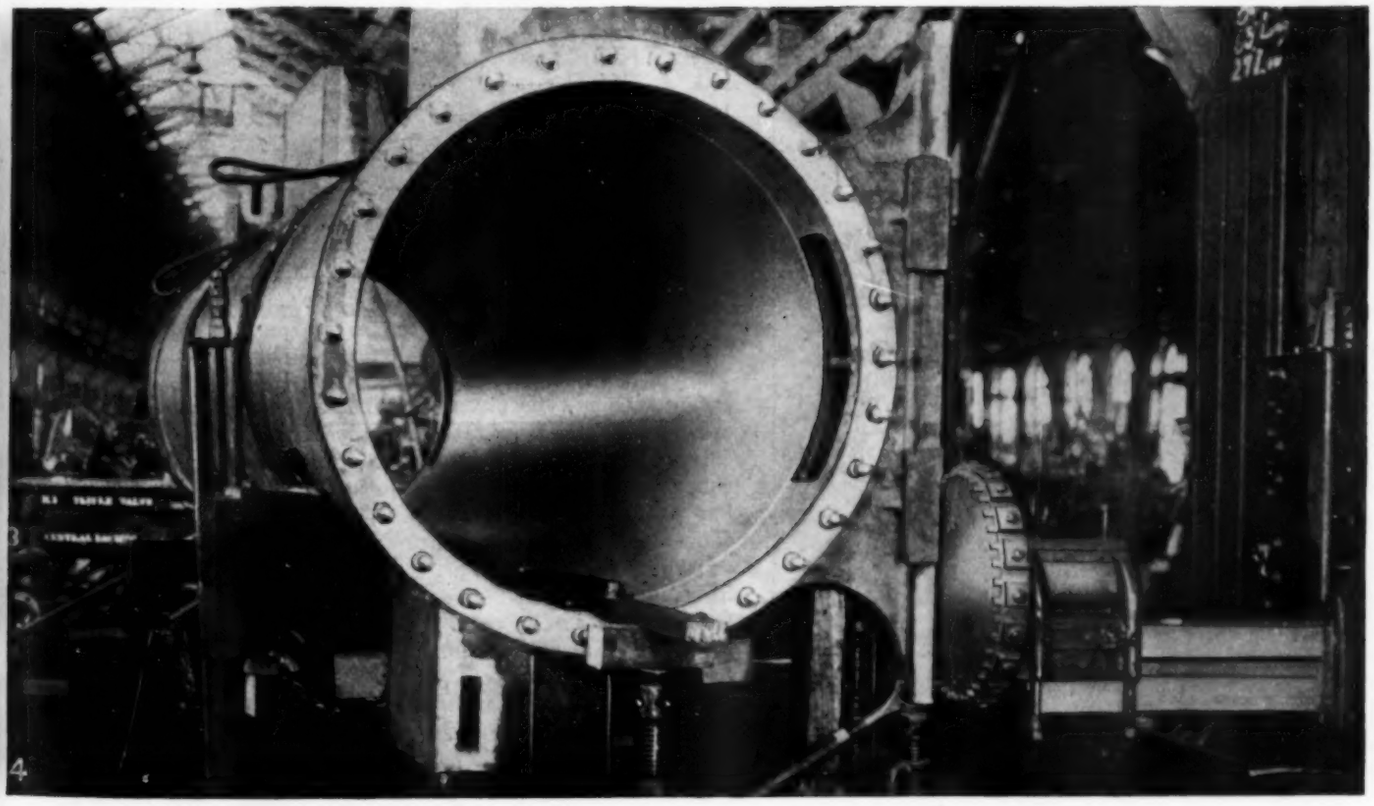
lugs, respectively, and also convey some idea of the magnitude of the work. The cutter is about 24 in. in diameter and has 48 inserted blades of high-speed steel. The blades are secured in slots in the cast-iron body of the cutter by means of short clamps, two blades being held by each clamp.

The cylinder is shown in Fig. 2 mounted on a 72-in. x 35-ft. lathe for boring. The illustration shows the method by which it was mounted, together with the wedges used for its alignment. Incidentally, the illustration also gives some idea of the size of the casting. The bar used for boring is a tubular casting, 20 in. outside diameter, 10 in. inside diameter and 25 ft. in length. A slot extending nearly the whole length of the bar serves to admit a portion of the traveling head. The part of the head working within the slot is threaded so as to form a nut for the screw used for traversing the head lengthwise of the bar.

The screw is 3 in. in diameter with an Acme thread of ¼-in. lead. The boring head is a massive casting having a long hub, 36 in. in diameter and provided with three arms, each of which carries a cutter.

Another operation in which the draw-cut shaper is used, is shown in Fig. 3. The milling attachment has been removed and its place taken by the regular shaper head in which a special toolholder is mounted. The work being done is machining the upper surface of one of the holding lugs.





Machine Tools With Built-In Electrical Equipment

By John W. Harper
General Electric Co., Schenectady

Changes of motor drive in machine tools—Individual drive replaces group drive—Increased use of machines having motors built in—Auxiliary motors used on large tools

NOT so long ago the majority of machine tools were driven by belts from line shafts operated through belting by a steam engine or some other form of prime mover. As the use of electrical power became more general and its advantages were more widely recognized, manufacturers began to change over from the line shaft to individual drive. This was usually accomplished by bolting a bracket to the machine and mounting a standard motor thereon. The motor in turn, was belted to the driving pulley. This method was an improvement, but at best it was only a makeshift and usually it was easily seen that the motor had been "attached."

A squirrel-cage motor is illustrated in Fig. 1 on a lathe that had been adapted to motor drive. The control indicates that this change was made long before the time of safety features and conduit wiring. However, in spite of such defects as they appear to us in the light of present-day practice, such a machine had decided advantages over its predecessors.

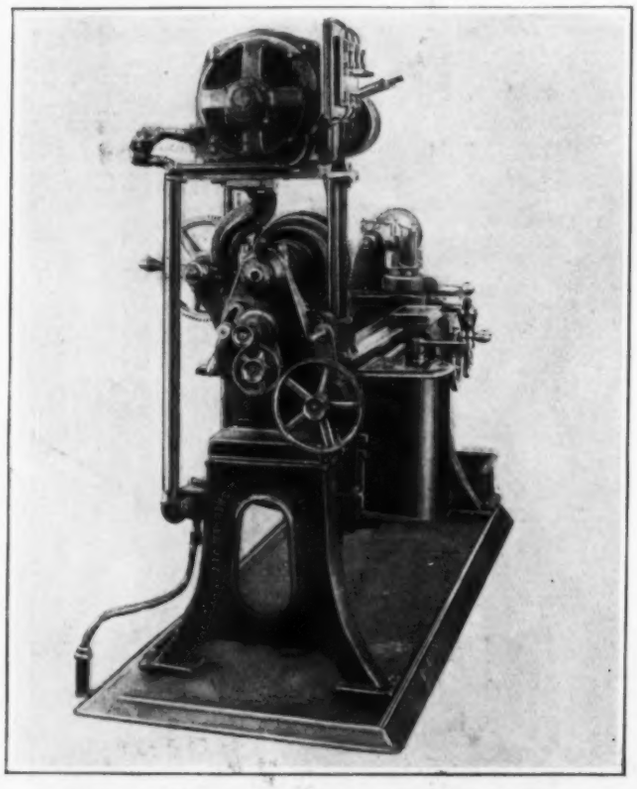


Fig. 1—Old type, belt-driven lathe adapted for motor drive

Such makeshift arrangements did not present a good appearance, and in a short time machines were on the market wherein the principle of motor drive had been given more consideration, as illustrated in Fig. 2. Here the motor is more or less a part of the boring mill, the latter being arranged so that the motor can be mounted

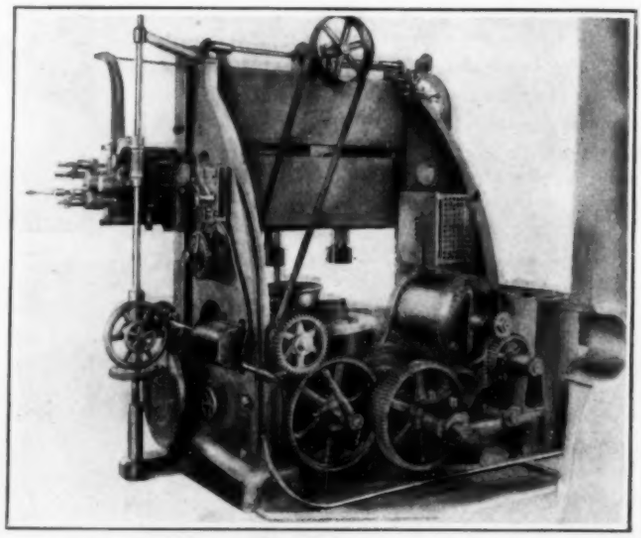


Fig. 2—Boring mill with motor and control

on the housing and geared directly to the drive shaft. The control had not, however, progressed to any great extent. Open-type circuit breakers and field rheostats were used. Some regard for appearances and safety can be seen in the way the wires are inclosed in flexible conduits, for most of their length at least. An attempt has also been made to assemble the control for the convenience of the operator by extending the drum-switch handle to the front. The lathe, Fig. 3, illustrates an arrangement that goes further and provides control by a handle on the carriage, operating a splined shaft on the drum controller. This procedure is still followed in present-day practice. It took a long time, however, to get away from open-type knife switch in the line.

As machine sizes increased and individual drive became more common, more and more attention was paid to appearances. Safety regulations were evolved and enforced, and eventually the open control was forced

out. Gears were covered up. Belts were done away with or, if used, were protected. The motor became more a part of the machine and in many cases standard motors were used and connected to the drive shaft.

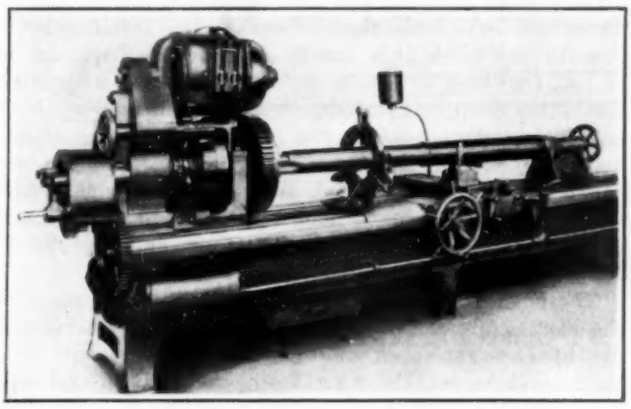


Fig. 3—Later form of motor-driven lathe with apron control

This advance was particularly marked in woodworking machines, which although not strictly machine tools are a very close ally. Molders, such as the one shown in Fig. 4, have their sides covered with belts when they are so driven. The machine illustrated has five motors, three of which can be seen. The other two are mounted vertically, the rotors being directly on the side-head spindles. The control is fully inclosed in the case near the floor. Each motor has individual push-button control, all the buttons being mounted in a group on the far side. Such a molder can be furnished as a unit, it being necessary only for the user to connect the three power lines.

The widespread use of built-in electrical equipment for woodworking machinery is largely because the motors can be mounted directly on the spindles and run at high speed. This, combined with the fact that the horsepower requirements are usually low, results in the use of a small motor, easily mounted. On the other hand, machine-tool shafts usually run at one speed, while the output from the motor is, as a rule, higher than for woodworking machines. As a result the motor must be larger, and excessively large if it is to be mounted directly on the drive shaft. Gearing is therefore used, allowing a higher speed, a more efficient and smaller motor, as well as permitting a range of spindle speeds by shifting gears. Due to increased knowledge of gears and gearing, this method of transmitting power is used much more extensively than heretofore, thus giving a more compact as well as a better appearance to the machine.

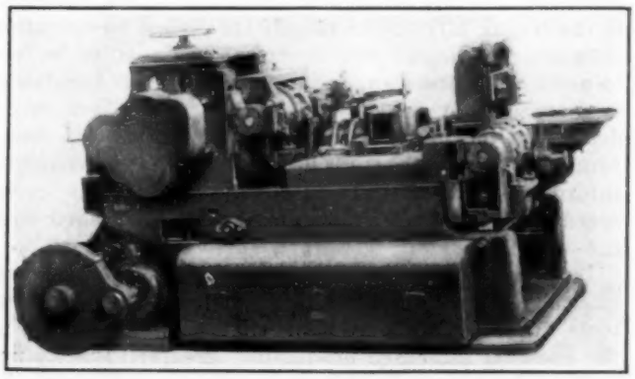


Fig. 4—Molder with five built-in motors and controls

Manufacturers are paying closer attention to appearance, and are not satisfied with a motor located high up on a lathe head where it has the disadvantage of being affected by most of the vibration; or of having a control on a radial-drill head overshadowing the drill itself. The machine tool is the main thing, while the motor and control are a means to an end.

In the latest types of machines being developed, there is a marked tendency to build the motor into the machine as an integral part. The lathe illustrated in Fig. 5 is an example. The motor is mounted in the enlarged pedestal under the headstock, while the control has a similar location under the tailstock end. Two milling machines recently announced, also have the motors enclosed in the pedestals.

Radial drills have recently had their design changed radically, and a number of manufacturers are bringing out models that have the motor mounted on an extension of the arm beyond the column. Small auxiliary motors are being mounted on lathe carriages and tailstocks, planer and boring-mill cross-rails, radial-drill heads, and at numerous similar points for increasing production by cutting down the time necessary for shifting these parts from one position to another. Another decided advantage for such a procedure is the saving in the physical energy of the operator, especially when very large machines are involved and the parts to be moved are very heavy.

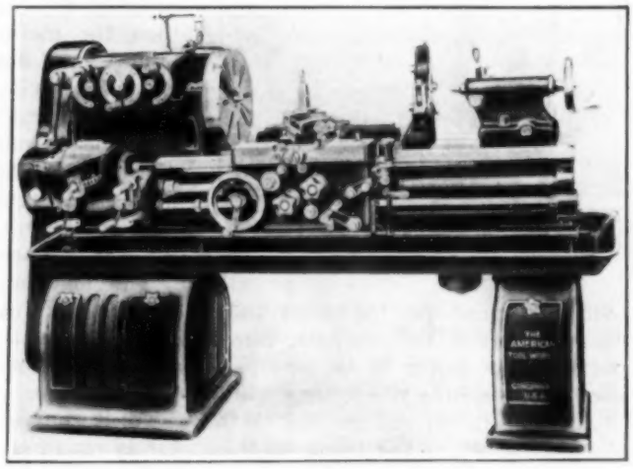


Fig. 5—Modern lathe with built-in electrical equipment

A typical example of what can be done toward building a motor and control into as simple a tool as a vertical drill, is illustrated in Fig. 6, while a more elaborate drilling machine is shown in Fig. 7. The latter machine would present quite a problem if belt driven. By using motors with round frames and by furnishing them without shafts, end shields or bearings, the manufacturer is enabled to mount them on his machine to the best advantage.

It would appear that the manufacturers of grinding machines have gone into the built-in idea to a greater extent that other machine-tool makers. One manufacturer has even gone so far as to build a motor generator into his machine when furnished for a.c., thus allowing the use of an adjustable-speed d.c. motor. The motor is mounted directly on the work spindle and rotates the work at different speeds, depending on the size. Fig. 8 shows an application of a motor and control to

a swing-frame grinder. One reason for the extensive use of built-in electrical equipment for grinders may be because the character of their operation more nearly approaches woodworking machines, since grinders have small motors of comparatively high speed.

Motors and controls that lend themselves admirably to this building-in are available today. The motor for the lathe in Fig. 5 for example, is standard, the pedestal being made large enough to accommodate it. To obtain the construction shown in Fig. 7 the manufacturer provided his own bearings, shaft and supports, as is the practice in the woodworking-machine industry. This method is probably the most satisfactory, for then the motor builder need not make a multiplicity of patterns and tools to suit everyone who has a different plan for mounting the motors.

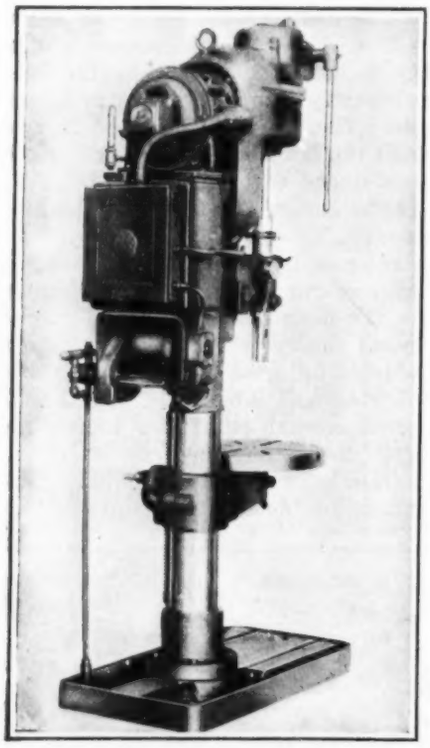


Fig. 6—Vertical drill with motor on column

The machine-tool builder can buy the stator and rotor and, by using different end-shield brackets, can mount the essential parts of the motor in various positions and locations about the machine where they will be most effective.

Alternating-current motors of the so-called "drawn-shell" type, where the frame of the motor is round and smooth, are available. The diameter is kept as small as possible and as many ratings as are consistent with good engineering are provided for each diameter. In this way the end shields and housings provided by the machinery builder can be used on several different ratings. These motors are particularly adaptable to 3,600 r.p.m. operation.

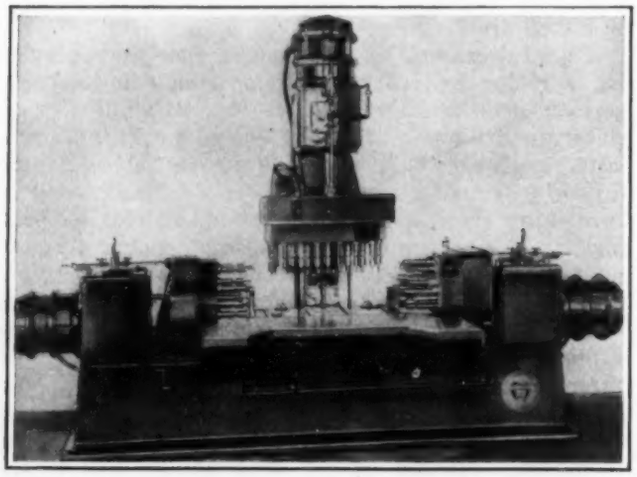


Fig. 7—Multi-spindle drilling machine with individual motors

Controls have been and are being simplified and reduced in size to make them more suitable for incorporation in machines. A small a.c.-starter, good up to 7½ hp., that will fit into a space 10 in. wide, 9 in. high and 8 in. deep, is available. It is furnished without any inclosing case, since the pedestal or frame of the machine acts in that capacity. The d.c. starters are usually larger but, even so, the needs of the machine-tool industry are being met with units as small and compact as it is feasible to make them and still obtain satisfactory operation.

There is still much room for further development of the electrically-equipped machine tool. The increasing use of constant-speed motors will be an incentive to such development, since a.c. motors of the squirrel-cage type, together with their control, form the most compact units obtainable for tool drives. Manufacturers of electrical equipment are more than willing to co-operate with the machine-tool builder, to the end that the most effective combination of tool and driving apparatus may be obtained.

One point that should be stressed to building motors into a machine, is the part played by ventilation in the motor output. If provision is not made for adequate ventilation, the motor will run hot, will not deliver its rated output and will be unsatisfactory generally. It is suggested in cases where the motor is to be inside the machine, that drawings showing the mounting scheme be submitted to the motor builders for comments.

Any aversion on the part of the manufacturer to submit such drawings and to give out information

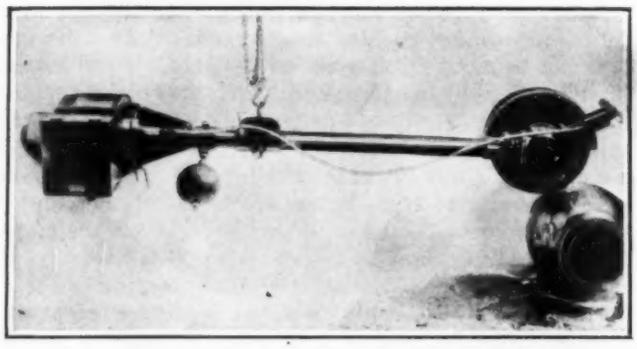


Fig. 8—Swing-frame grinder with built-in motor and push button control

regarding the operation and design of a new machine, is the wrong attitude to take if the fullest co-operation between mechanical and electrical parts is to be obtained. With the meager information often furnished, it is practically impossible for the motor builder to determine the best electrical equipment. It is, therefore, to the advantage of all concerned that as complete information as possible regarding sizes, duty cycle, space requirements, mountings, etc., be furnished with the original request, on special applications.

It is the feeling that there should be a more general interchange of ideas with the object of getting machine tools that are as near unit construction as possible, to the end that increased production, greater capacity per unit of floor space and betterment of quality may be attained.

Ideas from Practical Men

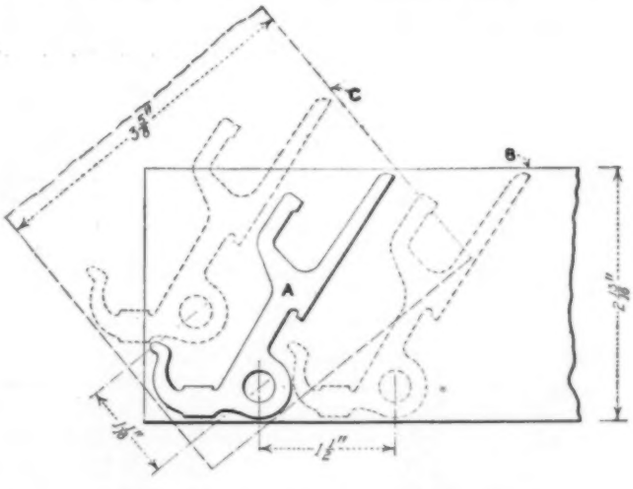
The department, "Ideas from Practical Men," is devoted to the exchange of information on methods useful to the machinery industries. Its scope includes all divisions of the machine building industry, from drafting room to shipping platform. Descriptions of methods or devices that have proved their value are carefully considered, and those published are paid for. The rates are from five dollars upward, according to their merit

Laying Out Blanking Dies

BY FRANK WALDO

In most production shops there are found punch-press operations for blanking material into various shapes, requiring a "run layout" of the stock to be used in order to determine the size of material required, the number of pieces to be blanked from the strip-length and the method of making the die. On some intricate shapes of blanks, it is necessary to apply a little "thought" in order to produce a layout giving the most number of blanks per square inch of material. Very often the first layout looks good enough and the die is made accordingly, without making a careful analysis of whether or not there is a better way to reduce the amount of raw material.

The layout illustrated is an actual example of a calculating-machine part and shows the advantage of using care to determine the best suited position of the strip for the blanking operation. The profile of the part or blank is shown at *A*. The designer made the layout and designed a progressive blanking die accordingly. In checking over the layout, however, the profile of the part



Method of laying out work-location for blanking dies

was drawn on a piece of tracing paper and laid over the original blueprint so that it could be positioned at all sides. Various layouts were made and the one shown at *C* proved the best. This may be seen by noting the following figures. The standard length of all sheet-metal strips is 72 in. By dividing the length of the strip (72 in.) by the length required needed for one blank, including the distance between blanks, the number of blanks that can be punched from a strip of sheet metal will be found. In the layout shown at *B* there will be 48 blanks and in the one shown at *C*, 67 blanks.

By method B, 2.812 × 72 in. ÷ 48 = 4.2 sq.in. per blank
By method C, 3.625 × 72 in. ÷ 67 = 3.9 sq.in. per blank

The saving in stock by using the last method is 0.3 sq.in., which is equivalent to one blank in every thirteen, or four complete blanks gained in a 72-in. strip.

Such a saving might appear small at first, but if several thousand pieces are to be produced, the results will be worth while. Therefore be sure of your layout before having your dies made and you will avoid unnecessary scrap.

Turning a Ball on the End of a Rod —Discussion

BY MILTON WRIGHT

Some months ago various readers of the *American Machinist* contributed to that magazine their ideas as to how best to turn a ball on the end of a rod, and submitted sketches to illustrate them. Some of the devices were very good and some were less so. Probably all of them would work, after a fashion.

The illustration herewith shows a device, *not* with which a ball *might* be turned on the end of a rod if necessary, but with which hundreds of such balls *have* been turned as a part of a shop's regular output. It was designed and made in the shop of the Waterbury-Farrel Foundry & Machine Co. to turn the ends of ball-and-socket pitmans that are used in many presses.

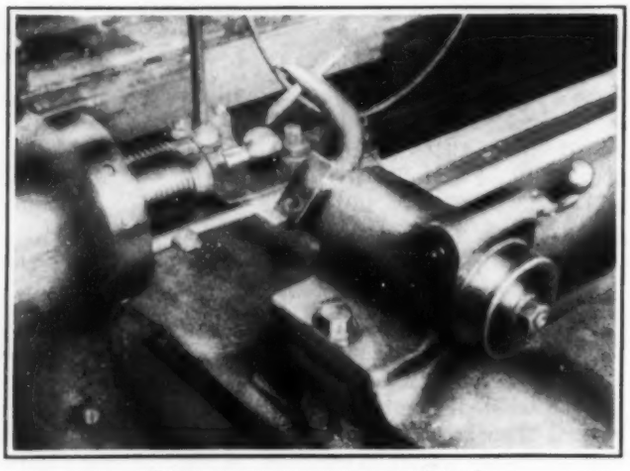
The casting that forms the basis of the fixture is clamped to the compound rest of a toolroom lathe by means of a couple of capscrews. To make sure that the axis of the spindle of the device should be at the same level as the centerline of the lathe the barrel of the device was bored in that lathe by means of a boring bar between centers.

The compound rest of the lathe is not necessary to the action of the device, but having the rest on the lathe, made the set-up for boring easy; since all that was necessary was to bolt the casting in place just as it was to be used and then swing the compound rest to 90 degrees. Of course it can be used in any other lathe, but then the user must take precautions to set it at the right height. In this lathe he cannot set it wrong without deliberate intent.

IDEAS FROM PRACTICAL MEN

The barrel is bushed with bronze and a spindle is provided to which a small worm-wheel is keyed. The spindle goes in from the back end, where it is fitted with thrust washers and an adjustable step-bearing to take up all end play. The wormshaft and crank handle need no explanation.

The tool holder is made like an ordinary clamp dog, with a cross hole near the end of the "tail" and a



Fixture to turn a round ball

setscrew put into the end to hold the cutting tool. There are two of the "dogs"; readily interchangeable. The one here shown will produce balls up to three or four inches in diameter, and the larger one—seldom used—will compass a circle up to 10 in. on the rare occasions when a ball of so large diameter is needed.

The cutting tool is any piece of drill-rod or round-sectioned high-speed steel that comes handy. Setting the tool in to take a cut is done by tapping it with a small hammer, and the size produced is entirely a matter of cut and try. To set up the device it has only to be clamped to the compound rest—which establishes the height—and the tool point centered crosswise of the lathe by matching it up with the point of the tail center. The rest is then locked against movement and the operator can go ahead with no worry as to whether or not the ball he is turning is going to be round.

Measuring Spur Gears by the Use of Pins

BY SAM TRIMBATH

Spur-gear teeth may be accurately sized by placing pins or rolls between the teeth and measuring the distance over the pins with a micrometer. To avoid the necessity of calculating every measurement, the accompanying table has been worked out.

It will be noted that a different size of pin is not used for every change in the number of teeth. Involute gear teeth may be accurately sized by a pin of any size that will rest upon the involute profile.

The sizes given in the table are for gears of 1 diametral pitch, and since gears of 5, 7, and 10 pitch are $\frac{1}{5}$, $\frac{1}{7}$ and $\frac{1}{10}$ the size of one pitch, the size over pins will be $\frac{1}{5}$, $\frac{1}{7}$ or $\frac{1}{10}$ the size given in the table, providing a pin $\frac{1}{5}$, $\frac{1}{7}$ or $\frac{1}{10}$ the size used in calculating the table is used. The size pin used for 1 pitch is 1.750 in. therefore the size pin to use for 5 pitch is 0.350 in.; 7 pitch, 0.250 in.; 10 pitch, 0.175 in., and so forth.

As the number of teeth increase, the more nearly straight the teeth become. Between 10 and 12 teeth in gears having 20-deg. pressure angle, there is a difference of 2.000 parts of the pitch in the pitch diameter, while the difference over the pins in gears of 14½-deg. pressure angle 2.021 parts of the pitch. Between 40 and 42 teeth there is again a difference in pitch diameter of 2.000, while the difference over the pins between gears of 20 and 14½-deg. pressure angle, is 2.004 parts of the pitch. Here the teeth become straight enough to jump from 42 to 52 teeth, then to 72, 102, 142, leaving the missing numbers to be found by interpolation. In calculating odd teeth, however, one more angle occurs than for even teeth, so that we must interpolate for 44 teeth between the figures for 42 and 52 teeth, while for 45 we interpolate between 43 and 53 teeth.

For numbers of teeth above 142 and 143, add the even 2.000 parts of the pitch to the last figure given. Example: For a gear of 145 teeth, 10 P.-14½-deg. pressure angle. The size given in the table for 143 teeth is 145.618. $\frac{145.618 + 2.000}{10}$ = size over pins for 145 teeth.

The sizes given in the table are standard; that is gears so cut will mesh at the proper center distances with no backlash. If 0.008-in. backlash is wanted, reduce each gear of the pair 0.008 inch.

Table for Measurements Over Pins, of Gears Having 14½ and 20 deg. Pressure Angles

To find size over pins, divide the figure in column under the pressure angle and opposite the number of teeth, by the pitch.

Example: 30 teeth, 7/9 Pitch, 20° P.A. $\frac{32,488}{7}$ = 4.641.

No. of Teeth	14½°	20°	Pitch	Size of Pin
10	12.415	12.413		
12	14.436	14.428		
14	16.455	16.440		
16	18.469	18.450		
18	20.482	20.458	Pitch	Size of Pin
20	22.493	22.465	4	0.4375
22	24.502	24.471	5	0.3500
24	26.511	26.476	6	0.2917
26	28.519	28.480	7	0.2500
28	30.526	30.484	8	0.2188
30	32.532	32.488	9	0.1944
32	34.538	34.491	10	0.1750
34	36.543	36.494	12	0.1458
36	38.548	38.497	14	0.1250
38	40.552	40.499		
40	42.556	42.501		
42	44.560	44.503		
52	54.576	54.512		
72	74.596	74.521		
102	104.613	104.529		
142	144.627	144.535		

No. of Teeth	14½°	20°
11	13.307	13.303
13	15.346	15.335
15	17.376	17.359
17	19.400	19.378
19	21.420	21.394
21	23.437	23.407
23	25.452	25.418
25	27.464	27.428
27	29.475	29.436
29	31.485	31.443
31	33.494	33.449
33	35.502	35.454
35	37.509	37.459
37	39.516	39.463
39	41.522	41.467
41	43.527	43.471
43	45.533	45.475
53	55.553	55.487
73	75.580	75.504
103	105.602	105.517
143	145.618	145.526

Note: For those numbers of teeth missing, such as between 42 and 52, 73 and 103 etc. Subtract the difference and add a proportionate part to the lesser figure. While this is not exactly correct, any error in the estimate will be divided by the pitch. An error of 0.001 becomes 0.0001 in the case of a 10-pitch gear; 0.0005 in a 5-pitch gear, and so forth.

Use table on the left to estimate for even teeth, on the right for odd teeth.

IDEAS FROM PRACTICAL MEN

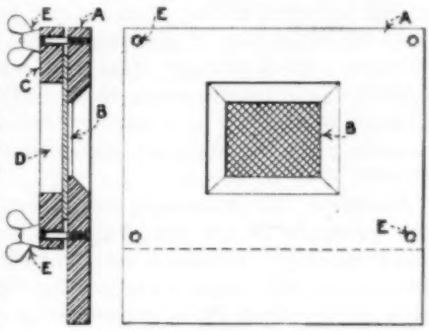
Optical Method for Checking Wire Mesh

By Douglas P. Muirhead

Glasgow, Scotland

It is sometimes difficult to check and count the number of meshes per inch in woven wire mesh under a microscope, and the following method has proved very satisfactory and much quicker than the old method. It is, of course, necessary to have an optical projection apparatus, such as is used for checking thread forms and profile gages.

The projection apparatus used by the writer has a magnification of 50 to 1, and it is a very easy matter to check even the smallest of mesh by this method. The sample to be examined is held in position in the frame shown in the illustration, which consists of a ¼-in. steel plate *A*, having a square, chamfered hole *B* cut in it. This hole is ½ in. square and is accurate for size and squareness. With this size of hole, the size of the image on the screen is 25 in., with the magnification quoted, and there is no difficulty in counting the number of wires in the mesh. The piece of mesh to be tested is held in position on *A* by means of another ¼-in. plate *C* and four small studs and wing nuts *E*. Plate *C* has also a square hole *D* cut in it, but this hole is ¾ in. larger on each side than the first, so as to cause no interference with the beam of light as it passes through.



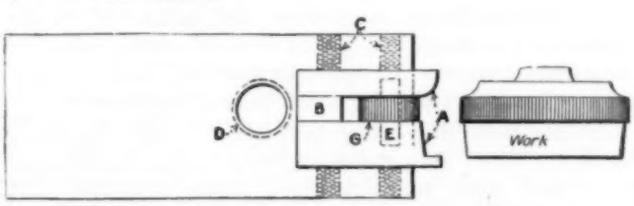
Device for checking wire mesh

It will be noted that the hole *B* is chamfered to practically a knife-edge in order to get a clearly defined image on the board. In operation, the plate *A* is held in the clamp on the projection-machine table, and the beam of light projected through the square hole to the board.

Combination Forming and Knurling Tool

By A. C. Barth

In setting up a Gridley automatic for a job that required both forming and knurling, in addition to several other operations, we found it necessary to combine operations as much as possible, in order to conserve space on the turret.



A tool for two operations

The tool illustrated was designed for both forming and knurling. The forming tool *A* was made in two sections, separated by the distance block *B*, and held in the holder by four screws, as at *C*. In addition, a clamp, bearing on top of both sections was attached by a stud screwed in the tapped hole *D*. The blind holes *E* were drilled in the sections before hardening and were used as bearings for the spindle of the knurling tool *G*.

By the use of this tool, the time of a separate knurling operation was saved, and more space was available on the turret for the various internal operations necessary to complete the work.

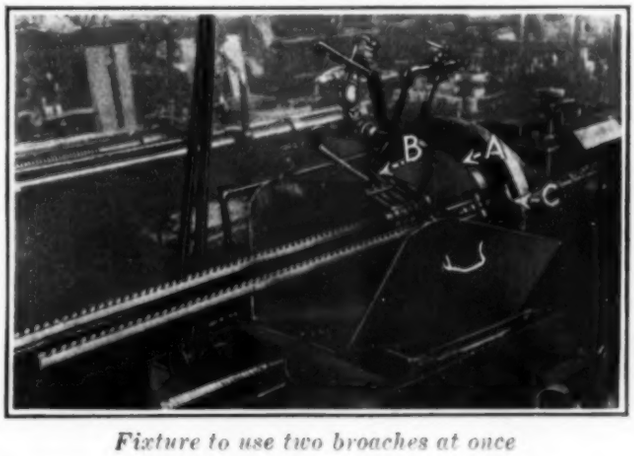
Using Two Broaches in One Machine

By William Denton

A method of using two broaches at once, and an adjustable work-holder to locate the keyways in the parts to be broached, are shown by the accompanying illustration. The scheme was devised and the fixture built in the shop of the Locomobile Co. of America, at Bridgeport, Conn., where it is employed to broach small levers and similar parts that require keyways at different angles.

The base, *A*, of the fixture is bolted to the faceplate of a Hudson-Lapointe screw-operated broaching machine, and mounted upon the base are two independently adjustable work-holders, *B* and *C*, that can be swivelled to any desired angle; the rounded end of each holder being graduated in degrees to facilitate setting.

The locating stops are radially adjustable to accommodate levers of different lengths and the central plugs are interchangeable with others to provide for different



Fixture to use two broaches at once

diameters of bore. A double holder is keyed to the crosshead of the machine to take the two broaches.

Of the small levers shown on the machine in the illustration, six pieces are broached at each cycle, three on each fixture. The number of pieces that can be handled at once depends, of course, upon the size and nature of the cut to be taken, but as long as the total load does not exceed the capacity of the machine the output will be approximately twice the amount that could be obtained from a single broach.

Practical Shop Problems

Questions of a Practical Nature will be answered in these columns

Annealing Tungsten Steel

Q. How can tungsten steel be annealed so that it can be machined?

I recently was given some motor valves of tungsten steel to machine. Since they were too hard to machine, I heated them and buried them in lime, but they seemed to be harder than before.

A. Your question is not sufficiently definite. There are so many kinds of tungsten steel that what is a good way of annealing one kind may not be the best for another. As an instance: if you are referring to tungsten tool steel with 18½ per cent of tungsten, you will have, as a rule, good results if you should heat the steel to 1,200 deg. and let it cool in the furnace.

The data sheets of the Society of Automotive Engineers and also those issued by the General Motors Corporation give valuable information on alloy steels and their heat treatment. Another source of such information is the American Society for Steel Treating.

Taper of Cock Plugs

Q. Can you tell me what is the standard taper for cock plugs used for air, gas, water and acids? Is the taper the same on all sizes?

What kind of reamer is used to get the taper holes in cock bodies round and smooth?

A. There is no definite recognized standard but most cocks are made with a taper of 1⅛ in. to the foot. You can ream with a taper spiral reamer with short lead of spiral or else finish the hole by grinding.

Any regular taper reamer will make a comparatively round and smooth hole of its own taper, providing it is properly ground for the metal on which it is to be used.

Force Necessary to Shear Steel

Q. Can you give me any information on the following? Having the strength in shear of a certain section of steel how can I determine the height from which a freely falling weight must be dropped in order to shear the section?

All the formulas I can find give the energy of a falling weight in foot pounds. Is there any way energy in foot pounds can be reduced to an equivalent direct force, expressed in pounds, so that it could be equated with shearing strength, also expressed in pounds?

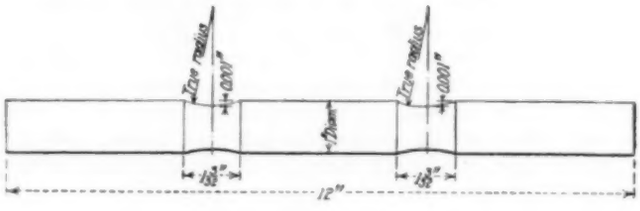
A. A number of items must be known before a definite statement can be made as to the number of foot-pounds required to shear a piece of steel of known section and of known qualities. Supposing that the steel is of rectangular section and that it is being sheared off close to its support, such as is the case when shearing with an ordinary power shear, then the shear blade will penetrate to ⅓ of the depth of the piece of steel before the steel will let go, that is, before a complete separation occurs. If the pressure on the steel were uniform during the travel of ⅓ of its thickness, then it would be a simple matter to compute the number of foot-pounds required for this work. This would be equal to the pressure per sq.in. multiplied by ⅓ of the thickness of the steel expressed in feet. For instance: for a piece of steel 2 in. wide and 1 in. thick and having a tensile strength of 65,000 lb. to the sq.in. (corresponding to a shearing strength of ⅘ of that amount) the number of foot-pounds would be $2 \times 52{,}000 \times \frac{1}{12} \times \frac{1}{3}$.

However, the problem is not as simple as that because the pressure is not uniform. It begins with a very small amount, increases very rapidly up to a certain maximum and then decreases again until it reaches zero at the point where separation occurs.

Of course, if the section of the piece is not as simple as we supposed it is, then the problem becomes still more complicated.

Radius Grinding

Q. We have a peculiar job of grinding as shown in the accompanying sketch. The round bar is to be radially ground in two places, the height of the arcs to be 0.001 in., and the work must be extremely accurate. Can you tell us the best way to do the work?



A. The easiest way to do this work is to take a wheel and size it down to a thickness of 1⅛ in., at least for a short distance at the rim, and then to true the edge to the proper curve. This is easily done by moving the diamond along a templet of the proper shape.

Plans for Shops

Q. It seems to me that there was published in the American Machinist a series of articles giving plans for the efficient layout of small and medium sized machine shops. Can you tell me in what issues they appeared?

A. The only shop plans published in the *American Machinist* have been those of fairly large machine-tool shops and some railroad shops. You will find such plans on page 1114, Vol. 54; pages 91, 173, 668, Vol. 55; page 259, Vol. 56.

Technical Abstracts

Case Hardening

An article on case hardening is of interest because it gives the results of some experiments on protective casings. The findings are that only copper can be universally used to protect the parts which are not to be hardened. Tin may be used on flat surfaces which remain absolutely horizontal. It will run off from inclined surfaces. Nickel is not dependable.

The thickness of the copper coating used varies with the depth of the case to be attained in the adjoining parts. For protection in all cases a copper layer 0.03 to 0.04 mm. thick must be used. This protects even when the case is as much as 2 mm. deep, and at a treating temperature of as much as 100 deg. C. At the same temperature a case depth of 1.0 to 1.1 mm. requires a copper layer only 0.02 to 0.03 mm. thick; and at 850° C. and 1.0 mm. case depth a protecting coating 0.01 to 0.02 mm. thick is sufficient.

Regarding methods of applying the protective coating, the Schoop spraying process is undoubtedly the most convenient. Unfortunately, the cost of installation is too high. Electrolytic deposition of copper salt solutions may be resorted to. Detailed directions are given for degreasing the work pieces and for lacquering those parts to which the copper coating is not to be applied. A number of recipes for suitable solutions are furnished.—*Die Werkzeugmaschine*, Feb. 28, and March 15, pages 77 and 135.

Lighting the Ford Industries

Henry Ford was one of the first manufacturers to realize the importance of adequate light in the factory and to install a lighting system that would keep the shop efficiency at night, and on dark days up to practically the same high level as on the brightest summer day. Dwight G. Baird, the author of this article, quotes Henry Ford in stating that one point absolutely essential to high capacity, as well as humane production, is a clean, well-lighted and well-ventilated factory. Some 700 men are detailed exclusively to keep the shops clean and windows washed and paint fresh. A clean orderly plant, Mr. Ford states, carries with it an atmosphere that subconsciously influences the employee, making him more cleanly and orderly in his work until his characteristics become a part of his make up. Dirt and disorderly plants are invariably inefficient.

A total of nearly 25,000 lights, over 10,000 of them being of the 300-w. size, were used in the Highland Park plant last year. The majority of lights now used are of the plain C-type but the tendency is to replace these with "Daylights." The aim is to provide an average allowance of 2 watts per sq.ft. in all plants, but it must not be thought that the light is at all wasteful—Mr. Ford does not believe in wasting light, or anything else for that matter. Where the work done requires closer scrutiny, as in the motor assembly building, the lighting units are mounted only 21 to 15 ft. above the floor and are spaced closely together. — *Light*, April, page 7.

British Industry

A report has been issued by the British Engineers' Association on "The Present Condition and Future Prospects of the Engineering Industry in Great Britain." Under consumption of many of the markets of the world, is a primary cause of the depression and is largely due to the inactive purchasing power. The high costs of production and consequent failure to secure a large enough share of export trade is, of course, the most serious factor; and these high costs are in the main due to the following causes, first the attempt of the British people to live on a higher economic plane than is justified by their annual output of new values. In other words, there is both individual and national extravagance. Second, the hours of working determined by the bargaining powers of the trade unions. Third, the remuneration of labor determined also by trade unions. Fourth, the arbitrary and frequent mal-adjustment of wage rates in obedience to the demands of strongly organized trade unions under threat of strikes. Fifth, restriction of output, which, on the part of labor is due partly to the fear of unemployment on the workman's side and to financial limitations on the employer's side. Sixth, a burden of national and local taxation too great to be borne without serious loss of vitality. Seventh, too many non-producers taking too large a share of the consumers' payments. — *The Engineer (England)*, April 10, p. 415.

Investigation of Gear Tooth Stresses

It is well known that the equations for the deformations of an elastic body under stress are identical in form with those for the stream lines and equipotential lines of liquid flow. One could reproduce the stress curves in a gear tooth by representing the outside forces on the tooth by a pair of nozzles spouting water into the tooth shape. If one injects a colored liquid into a colorless liquid between a pair of glass plates, the deformation curves could actually be made visible. Hele Shaw and W. M. Thornton have used a method of this kind to study the lines of force in an electric armature, and have obtained excellent pictures. Prof. R. Doerfel in Bruenn has not carried out the experiment in the case of gear tooth deformation, but he discusses the shape of the deformation curves theoretically and gives a diagram of them. As a practical working rule, the author recommends that the path of action of the gear should be divided by the pitch point in a ratio equal to the transmission ratio. For very large transmission ratios, the path might well fall on only one side of the pitch point. Small safety additions should be made at the ends. This would seem in general to mean unequal addendum teeth.—*Zeitschrift des Vereines Deutscher Ingenieure*, February 7, p. 149.

American Machinist

Established 1877

KENNETH H. CONDIT AND FRED H. COLVIN, *Editors*

A Real Code of Ethics

THE action of the National Machine Tool Builders' Association in adopting, tentatively, the report of its Code of Ethics Committee is worthy not only of comment but of commendation as well. As the code has not yet been finally adopted it is probably not desirable to publish its details now, but it is entirely proper to praise the work of the committee and to voice the hope that final adoption will be accomplished at the annual meeting of the Association.

Based on the code of ethics set up by the Chamber of Commerce of the United States, which has already been adopted by the Association, the report specifies in unmistakable detail just what constitutes infraction of the various principles stated in the code. It may be, as one member remarked, that some manufacturers have never thought of some of the unethical practices mentioned, but at least there can now be no excuse for re-inventing any of them. The report states clearly that each unethical practice is destructive of a principle of the code and leaves no room for hairsplitting as to just how far a would-be infringer can go before he steps over the line.

Mr. Ford Boosts Aviation

COMMERCIAL aviation has received a decided impetus in securing the interest of Henry Ford and of his organization. The inauguration of an air express service for his own business will go far toward determining the advantages of this method of transport as well as giving reliable data as to costs and reliability.

The planes used are of special interest from the mechanical viewpoint, being of all metal construction, even to the wing coverage. They have been designed and built for both safety and reliability, as well as low maintenance cost.

It is hoped and expected that Mr. Ford will seriously consider some of the contracts for carrying mail over the new routes that are now being projected. These will fit in nicely with developing an express business and establishing routes in various parts of the country.

The entry of Mr. Ford into the field of commercial aviation is one of the most hopeful omens for its development into a business success. He has three of the fundamental elements necessary to a final success, tenacity of purpose, a keen sense of business values and ample capital to carry on over the lean months in the beginning of a new venture. It may be the beginning of a new phase of aviation as a real industry.

Electricity and Machine Tools

ELECTRICITY is but a few centuries old. It is true, the ancients knew that a piece of amber, rubbed the right way, will attract small objects, but that was all they knew about it. In the time of Queen Bess, one or two bricks were added to the structure, but it remained a little heap of bricks, at the best; without definite form and of no use at all. Even Franklin could only increase the size of the little heap and point out one doubtful use. And then came Galvani and Volta who showed that electricity can flow as a current. From that time on the properties and laws of that flow were studied by multitudes of investigators and the result is that we have electricity as we now know it with its thousands of uses.

A century and a half of study—one-half century of invention and application, and see what we have.

Chips have been made for many centuries and it has been known just that long that chips flow; but how they flow, what is the law controlling that flow is still in darkness for us and we keep on toddling along as well as we can.

We have had the lathe and the lathe tool many years. We have had the motor but a few years. But we apply the motor to the lathe and know all about the motor and nothing about the lathe or its tool.

Just Suppose

JUST suppose you and your flivver are racing him and his across the desert, each one hoping to find the best camping place at the other end by getting there first. And suppose, while you are going neck and neck, if you can call it that, you discover that your radiator needs water and he finds he is out of gas, wouldn't you forget, for a moment, that you are rivals, trade some water for some gas and go on racing, hoping that the best man and the best flivver may win? Of course you would.

Now suppose your competitor in the manufacturing game and you are both stalled for lack of progressive methods, but each one with a few valuable trade secrets which the other one does not have. Don't you think it would be wise to invite each other in and bid him help himself to whatever knowledge he can dig up? And wouldn't you then be in a much more favorable position to continue the race?

Well, you say, but gas is a different thing from knowledge, almost the opposite one might say.

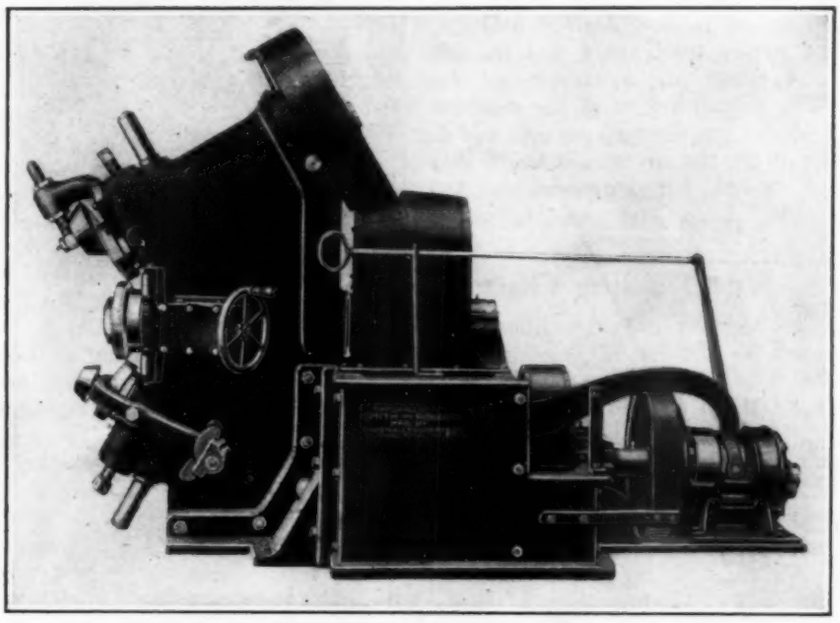
Now you are getting funny, but—

Just suppose

Shop Equipment News

Marshalltown Double-Rotary Bevel Shear, No. 234

A rotary bevel shear designed to combine the standard bevel shear with the inverted bevel shear, making it possible to bevel from both sides of a sheet without turning, has been added to the line of machines, manufactured by the Marshalltown Manufacturing Co., Marshalltown, Iowa.



Marshalltown Double-Rotary Bevel Shear, No. 234

The machine is heavily constructed and is rigid when in operation. The design was brought out to save labor and time, where large sheets are beveled in quantities, by the elimination of the reversing of the work.

The capacity of the machine is for ¾-in. material or lighter, the depth of the throat is 4 in. and the cutting speed is 8 ft. per minute at 285 r.p.m. The sizes of the cutters used are 9x2 in. on the upper and lower shears and 11x2 in. on the center.

Either belt or motor-driven machines are furnished, the former having a friction clutch pulley and the last a friction clutch gear, so that the shear may be stopped and the motor allowed to remain running. The machine is driven by a 7½-hp. motor running at 1,200 revolutions per minute.

The distance from the floor to the cutting edge of the top cutter is 36 in. and to the lower cutter is 25 in. The floor space required is 4 ft. 6 in. x 7 ft. 4 in. The net weight of the machine is 8,500 pounds.

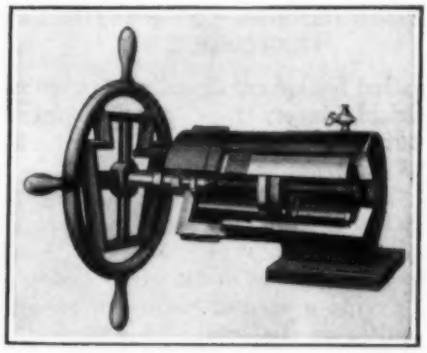
Keystone Safety Lubricating System

A method of applying grease from a central point, to bearings located throughout a piece of machinery, has been developed by the Keystone Lubricating Co., Philadelphia, Pa. The principle of the system is to force grease through pipe lines with an adequate pressure and distribute lubrication throughout a given unit.

The lubricator illustrated is used in connection with a converter cup so arranged that when pressure is applied to the lubricator, grease is supplied with a suitable force to any group of bearings, within a considerable distance. A pipe system is employed so that each bearing or portion to be lubricated is connected by a direct pipe to the central lubricator. At each bearing inlet a pressure-reduction grease valve is provided and so adjusted as to allow the entrance of the necessary requirement of lubrication, in accordance with the source of supply. In this way, with proper adjustment, each bearing receives the correct amount of lubrication, and inaccessible and hazardous places are lubricated without difficulty.

A booster cup is placed on each bearing, filled with an independent reservoir of grease, under a spring pressure and is automatically discharged according to the bearing's requirements. In order to avoid dirt, waste or foreign matters from clogging or getting into the cups and valves, a strainer is connected into a union attached directly to the lubricator.

The advantages claimed for this method of lubrication are that the bearings will receive longer life, through the more constant attention that they will receive, and that a decrease in operating cost, a lessened depreciation to machinery and an increase in production will result. The development of this system has decreased to a minimum the danger to which oilers and greasers are ordinarily subjected, in their necessary duties.

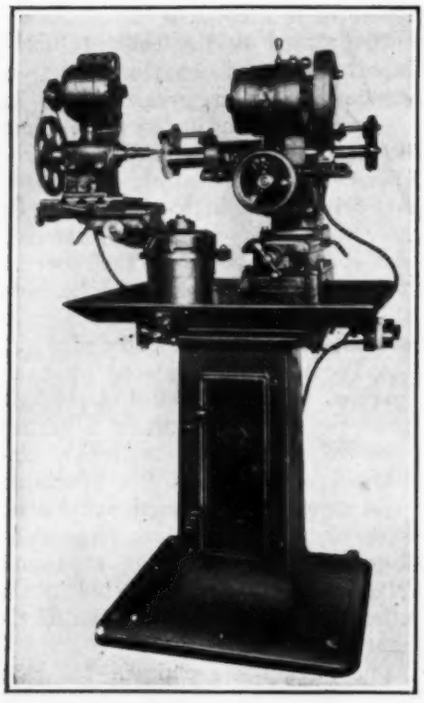


Keystone Safety Lubricating System

SHOP EQUIPMENT NEWS

Keller Universal Cutter and Radius Grinder, R-6

The cutter and radius grinder illustrated has been placed on the market by the Keller Mechanical Engineering Corp., 70 Washington St., Brooklyn, N. Y. The machine is intended for grinding milling cutters, reamers and similar tools, and is



Keller Universal Cutter and Radius Grinder, R-6

suited for spherical and radius, cylindrical, taper, face, angular form, flute and blade, clearance and back-off, internal and surface operations.

There are six separate movements on the machine, giving a wide range of adjustments and adaptability to many classes of work. It is possible to grind a desired radius on an end mill or on the corner of a face mill, at the same setting used for the rest of the grinding of the cutter.

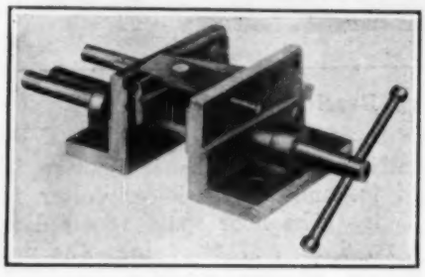
The machine is self-contained, driven by two motors, one for the wheel drive and one for the work drive, and it has a spindle speed of 5,100 r.p.m. The ball-bearing wheel spindle is mounted on three slides, giving movement longitudinally, vertically and transversely of 4¾ in. each The work-holding stretcher is mounted on a turntable so that it can be swung with relation to the wheel in order to grind the radius of the work. A cutter-grinding fixture is furnished for holding mills of all types, and for grinding the tracer points and similar work, the cylindrical- and face-grinding fixture, equipped with a motor, is provided. Five work speeds are adjusted to suit the work, by means of cone pulleys. The work table travel is 210 deg. angular, 3¼ in. radially and 1⅞ in. cross-slide. The size of the table is 6¾ in. x 8½ in. and it is provided with three ½-in. T-slots.

The cutter head can be tilted 45 deg. in either direction and the spindle of the work-holding attachment can be swiveled in a vertical plane and locked in any desired position. The wheels used are ¾ x 4 in. and ½ x 4, either cup or saucer.

The overall height of the machine is 60 in., the floor space required is 44 x 40 in., the net weight is 800 lbs., and crated for shipment is 875 pounds.

West Drilling Vise

The light-weight vise illustrated, known as the D. S. West drilling vise, is being marketed by the Armstrong Manufacturing Co., 4 Second St., Portland, Ore. Either jaw of this vise may be clamped to the table of the drilling machine so that the remaining jaw is movable.



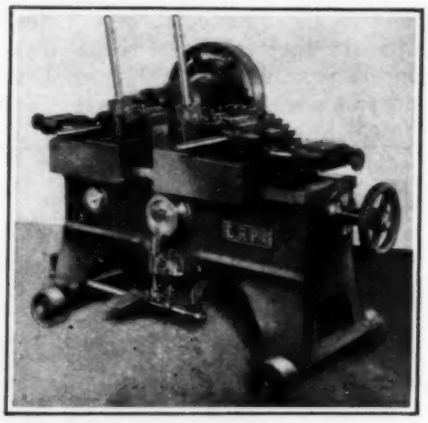
West Drilling Vise

The notches machined in the inner edges of the jaws form a rigid support for all forms of flat and square work, holding such material in a level position so that tapping, drilling or milling can be accomplished. Vertical and horizontal grooves are provided for holding round material, and by the use of cross rods in combination with tne ledges, irregular shaped work can be secured in various positions.

The vise is recommended for all general machine shop work and wherever the use of light weight vises is required.

Auerbach Collar and Head Press

A machine for pressing collars and heads of various shapes on spindles, axles, bolts and similar parts is being manufactured by Paul Auerbach, Saalfeld-Saale, Germany, and marketed in this country by W. Edlich, Delawanna, N. J.



Auerbach Collar and Head Press

The machine is capable of handling any length of material, and pressing collars one behind the other, close together. It is also adapted for stamping heads on round material, such as axles and bolts, and form heads on screws and rivets. In addition to this, the machine can be used for bending purposes.

In operation, the work is clamped in a die located on the stationary head on the left-hand portion of the machine body. An eccentric lever locking device is used for clamping the work so that a positive grip is maintained. The movable portion or press head then forces the work into the die, forming the shape to correspond with the opening. A hand wheel is operated for adjusting the stationary head to the width of collar desired. Casters are attached for transportation purposes, and are removed when the machine is installed.

The advantages claimed for this machine are that collars are produced in less time than by welding or turning from the solid methods, that the material is squeezed to a finer grain and that straightening of the work is unnecessary due to the firm method of gripping while it is being formed.

The machine is solid in construction, and is provided with stop rods to prevent any movement of the work during the pressing operation. A

SHOP EQUIPMENT NEWS

safety clutch is attached that acts in case the maximum pressure is exceeded, thereby avoiding possible destruction of the working unit.

The machine is made in three sizes, taking maximum diameters of 37, 53 and 85 mm. The horsepower required for operating is 2 to 3 on the smaller size, 3 to 4 on the medium and 4 to 5 on the larger size. The corresponding production is 120, 100 and 60 pieces per hour.

Industrial Crawling Tractor Crane, Type DC

An improved 10-ton crawling tractor crane has been brought out by the Industrial Works, Bay City, Mich. The design is similar in outward appearance to the former types built by this company, but its hoist embodies a design of features that it is claimed make this machine the fastest, simplest, sturdiest, most rugged and most economical to operate.

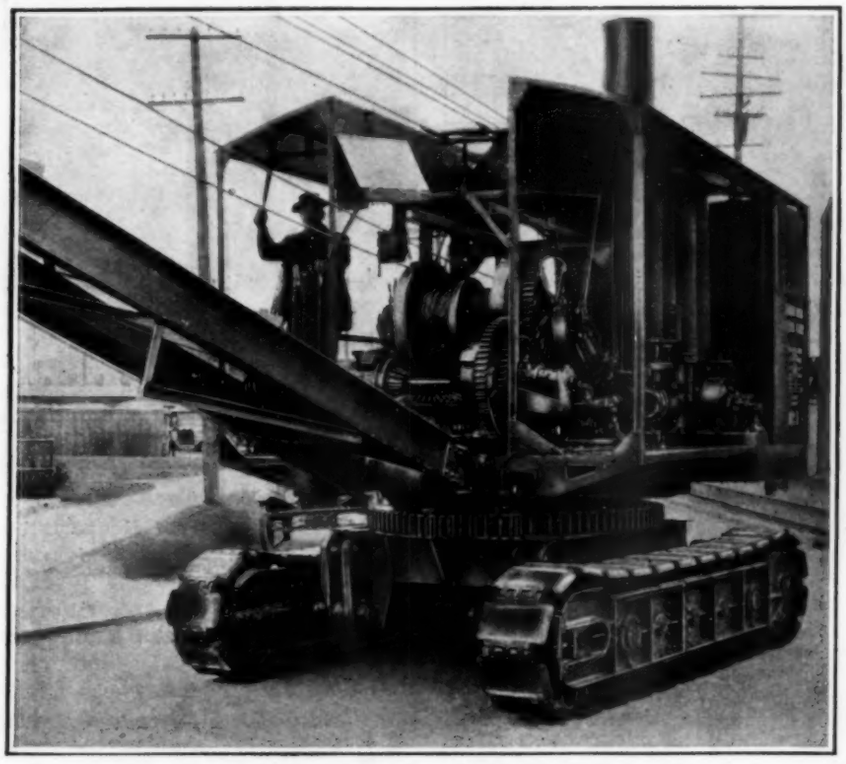
An important feature is the system of split gears by which each tractor belt is separately controlled. Two concentric-vertical propelling shafts at the axis of revolution, lead two independent but concentric trains of spur and bevel gears, each operating one tractor belt. Each belt is directly controlled by two friction clutches and brakes in the revolving upperworks that give independent, definite and easy means of control over each belt while operating.

Motor speeds have been increased 25 per cent, providing ample speed for the fast handling of materials. A double-clutch mechanism operates the two slewing-bank clutches by means of one lever. The direction of slewing is changed at will by the movement of the slewing bevel-clutch lever. No reversal of the engine is necessary.

The crawling tractor belts are of ample length to give stability when lifting over either end, on any kind of ground. The center distance between the two end sprockets is 10 ft. All functions of this crane are independent and operated by separate levers, conveniently placed on the operator's platform in the revolving upperworks, permitting different combinations to be utilized.

This crane can be equipped to operate with a steam engine, electric motor, gasoline motor or fuel-oil engine of the Diesel type to suit the operating conditions. It operates with clamshell or dragline bucket, electro-magnet hook and block or grapple, and is readily convertible into a shovel or a pile driver. Any equipment that operates on a boom can be applied. Care has been used to combine the necessary strength with the light weight essential to a tractor crane.

It is claimed that this crane is the only crawler type that steers and propels by friction clutches, and to be the only crane having a friction clutch and band brake for each tractor belt. These features make maneuvering in close quarters comparatively simple.

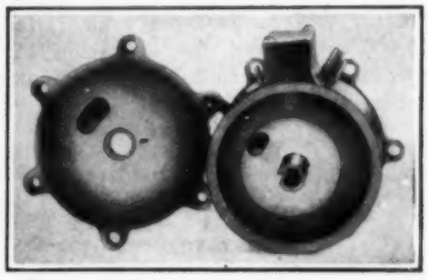


Industrial Crawling Tractor Crane, Type DC

Milne Rotary Valveless Compressor

The compressor illustrated, has been developed by John Milne, 273 Greenwich St., New York, N. Y., to operate at a high speed without the usual flywheel, piston, crankshaft and pulleys found on compressors. A guided motion of the inner rotors in connection with the casing causes the suction and the discharge actions.

The body of the unit comprises a cast cylinder, divided into two equal compression chambers, into which an eccentric and ring are mounted. The movement of the ring is controlled by a sliding guide located in the upper portion of the cylinder. As the eccentric is rotated, the ring passes around the inner wall of the cylinder, with a rotary - reciprocating motion, and when at its maximum position off center, an intake port is actuated so that air or liquid is drawn into the chamber. As the rotation is continued, the eccentric throws the ring around, causing the air or liquid to

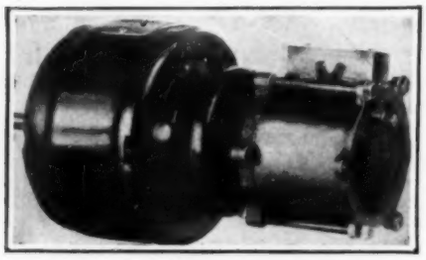


Milne Rotary Valveless Compressor

SHOP EQUIPMENT NEWS

be compressed on the opposite side of the cylinder until a point is reached that is provided with a port in the ring corresponding with an opening in the cylinder head, allowing an outlet for the compressed air or liquid.

The features of this compressor are that it is compact and composed chiefly of circular parts, making its construction of a simple nature. No coupling is required since the unit is a direct motor-mount and does



Compressor mounted to motor

not require a speed reducer. The operating or working portions consist of three moving parts, all suitably inclosed in the cylinder chamber.

It is claimed that in operation this compressor is practically noiseless and vibrationless, and that its weight and space are approximately one-third those of the reciprocating type of compressor.

Cooling has been provided for by grooves or cavities in the partition between the chambers and in the cylinder heads, allowing a suitable cooling medium to be circulated.

The capacity of this type of compressor will range from ¼ cu.ft. to 10,000 cu.ft. and for operation at speeds from 350 to 3,600 revolutions per minute.

Mercury Heavy-Duty Trailer, Type A-510

An industrial trailer capable of handling heavy loads has been placed on the market by the Mercury Manufacturing Co., 4118 South Halsted St., Chicago, Ill.

The frame is made of T-section iron, reinforced with angle sills. Cast-steel wheels, fitted with roller bearings, are mounted on heavy forged axles. Brackets are seated to the stem of the T-frame and are provided with a 3 in. bearing surface for each end of the axle.

The fifth wheel or swivel consists

Mercury Heavy-Duty Trailer, Type A-510

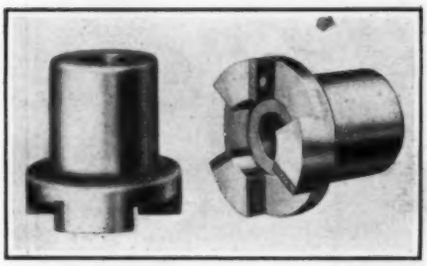
of two cast-steel plates resting on one another and held by an adjustable king bolt. A ball-bearing race of large size provides a stable construction.

The trailer is made in three sizes 36x72 in., 42x72 in., and 48x84 in., all having a capacity of 4 tons.

Racks, made of 1-in. pipe and 33 in. high, are furnished as standard equipment. Provision is made for fastening various styles of bodies to the frame. The regular wheels can be substituted by rubber-tired wheels if desired.

Boston Gear Works Flexible Insulated Coupling

The coupling illustrated is being marketed by the Boston Gear Works Sales Co., Norfolk Downs, Mass. The design, on which a patent has been applied for, follows the principle of



Boston Gear Works Flexible Insulated Coupling

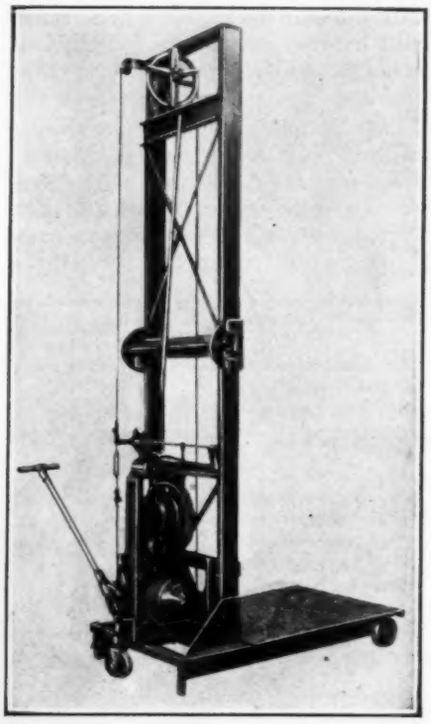
a three-jaw clutch. The working shoulder of each jaw is protected by a non-metallic cushion which is intended to absorb possible backlash and make the drive practically noiseless.

Up to 2¾-in. hub diameters the coupling is made in steel only, while above this point cast iron is used. The hubs of the latter range of sizes are left unfinished. The company has prepared a circular containing data useful in selecting and applying the correct size of coupler for a given purpose.

Lewis-Shepard Worm-Drive Stacker

A light-duty, worm-drive stacker has been added to the labor-saving handling equipment manufactured by the Lewis-Shepard Co., Watertown Station, Boston, Mass.

This machine is driven by a ½-hp. motor, making possible a lifting speed, ranging from 9 ft. per minute on 1,000 lb. capacity to 14 ft. per minute on 500 lb. capacity. A "dead-



Lewis-Shepard Worm-Drive Stacker

man" type of controller is used, with limit stops at both the top and the bottom of travel. The stacker can be equipped with an elevator type of control, allowing the operator to ride up with the load and stop the lifting platform at any desired height.

The steering handle elevates the front feet of the stacker to a height not less than 1¼ in. above the floor, in addition to steering the machine in any position. The hinge lock is of an improved type, being automatic in action, so that when the top section of the stacker is elevated, the lock automatically becomes effective. In this way there is no danger of the top section folding over if the power is not shut off.

In addition to the piling and unpiling of materials, this machine is handy for various types of work.

News of the Week

Standardization Work Again Features A. G. M. A. Annual Meeting

E. J. Frost elected president to succeed Markland

Standardization work by committees and papers of genuine merit featured the ninth annual meeting of the American Gear Manufacturers' Association at Pittsburgh, May 6 to 9. The program was unusual in that it covered a period of four days, devoting the first to technical standards. The committee meetings were under the direction of B. F. Waterman of the Brown & Sharpe Manufacturing Co., chairman of the general standardization committee.

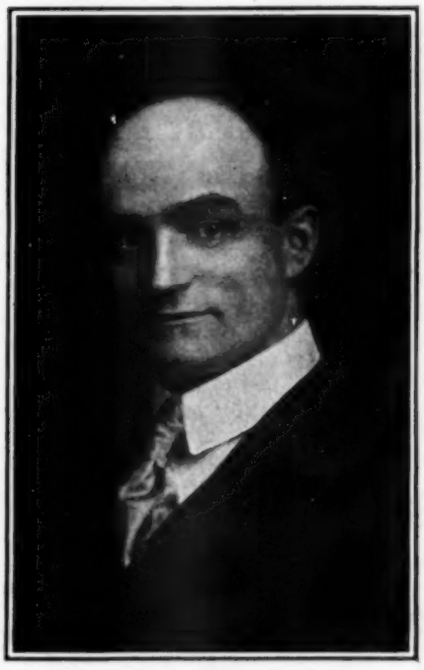
During the general sessions, opened on the second day, reports were read by the chairmen of the many committees and sub-committees. Scattered among the reports were the several papers that were, without exception, indicative of great comprehension on the part of the authors, of present conditions in and future possibilities of the gear industry.

George L. Markland, Jr., of the Philadelphia Gear Works and president of the A. G. M. A., opened the general sessions by welcoming the delegates and giving a short talk on the business man's political obligations. He advised the association to devote more time to the commercial side of the gear business. That there is a tendency to do so was indicated by the nature of some of the papers presented.

The Central Gear and Manufacturing Co., of Indianapolis, Ind., was admitted to membership with W. Carleton Starkey as executive representative. William W. Miller was elected as an additional associate representative from the General Electric Co., Schenectady, N. Y. John P. Breuer was elected an associate representative from the Barber-Colman Co., Rockford, Ill. and A. R. Ford and F. J. Glasheen were elected as additional associate representatives from the Frost Gear and Forge Co., of Jackson, Mich.

Officers elected for the year ending with the tenth annual meeting in the spring of 1926 are E. J. Frost, of the Frost Gear and Forge Co., president; A. F. Cooke, of the Fawcus Machine Co., Pittsburgh, Pa., first vice-president; B. F. Waterman of the Brown & Sharpe Manufacturing Co., Providence, R. I., second vice-president. C. F. Goedke, of the William Ganschow Co., Chicago, Ill., continues as treasurer and T. W. Owen, 2443 Prospect Ave., Cleveland, Ohio, continues as secretary. E. W. Miller of the Fellows Gear Shaper Co., Springfield, Vt., was elected a member of the executive committee. E. J. Frost, C. F. Goedke, and W. H. Phillips of the R. D. Nutall Co., Pittsburgh, Pa., were re-elected members of the executive committee.

The program arranged for the entertainment of visiting ladies allowed for little idle time. It included visits to the plant of the Heinz Co. and the broadcasting station KDKA of the Westinghouse Electric and Manufacturing Co., a baseball game, the theater, bridge and luncheon at the Edgewood Country



E. J. FROST

Club, attendance at the banquet of the association and tours of the shopping district, Highland and Schenley Parks, with a visit to the art museum and library.

The members of the association paid a visit to station KDKA and made an inspection trip through the plant of the Jones & Laughlin Steel Co.

J. C. McQuiston, publicity manager of the Westinghouse Electric and Manufacturing Co., and chairman of the publicity committee of the A. G. M. A., was toastmaster at the banquet of the association. Dr. Carl Wallace Petty spoke on the subject, "Miracles of Loyalty." The KDKA Little Symphony Orchestra provided the music.

These papers were read during the four days of the meeting:

Various Viewpoints of Standardization, by A. H. Timmerman, president of the Electric Power Club. Mr. Timmerman is also vice-president and chief engineer of the Wagner Electric Co., St. Louis, Mo.

The Development of the Gear Art, by Frank Burgess, of the Boston Gear Works, Norfolk Downs, Mass.

Limiting Spur Gear Design, by C. H. Logue, Consulting Engineer, Syracuse, N. Y.

Photoelasticity and Its Application to Gear Wheels, by A. L. Kimball, of the General Electric Co., Schnectady, N. Y.

What Has the Automotive Gear Manufacturer Added? by E. B. Baltzly, of the Warner Gear Co., Muncie, Ind.

The Gear Industry on the Pacific Coast, by Frank B. Drake, of the Johnson Gear Co., Berkeley, Calif.

What Are the Future Possibilities in Gear Manufacturing Equipment? by F. W. England, of the Illinois Tool Co., Chicago, Ill.

Progress and recommended practice reports were submitted by a majority of the committees and sub-committees, a complete list of which, with the names of the chairmen, follows:

General Standardization, B. F. Waterman, Brown & Sharpe Manufacturing Co., Providence, R. I.

A.G.M.A. Sectional Committee of American Engineering Standards Committee, B. F. Waterman.

A.G.M.A. Representatives of A.S.M.E. Research Committee on Gears, E. W. Miller, Fellows Gear Shaper Co., Springfield, Vt.

Spur Gear, J. L. Williamson, Fellows Gear Shaper Co.

Bevel and Spiral Gear, F. E. McMullen, Gleason Works, Rochester, N. Y.

Nomenclature, E. W. Miller.

Sprocket, G. M. Bartlett, Diamond Chain and Manufacturing Co., Indianapolis, Ind.

Keyway, L. G. Nilson, Nilson-Miller Co., Hoboken, N. J.

Uniform Cost Accounting, R. C. Ball, Philadelphia Gear Works, Philadelphia.

Metallurgical, C. B. Hamilton, Hamilton Gear and Machine Co., Toronto, Ont.

Tooth Form, H. E. Eberhardt, Newark Gear Cutting Machine Co., Newark, N. J.

Herringbone Gear, A. F. Cooke, Fawcus Machine Co., Pittsburgh, Pa.

Worm Gear, J. C. O'Brien, Pittsburgh Gear and Machine Co., Pittsburgh, Pa.

Gears and Pinions, Electric Railway, Mill and Mine, W. H. Phillips, R. D. Nutall Co., Pittsburgh, Pa.

Library, E. J. Noble, Horsburgh & Scott Co., Cleveland, Ohio.

Nominating, W. H. Diefendorf, Diefendorf Gear Corporation, Syracuse, N. Y.

Differential, S. O. White, Warner Gear Co., Muncie, Ind.

Transmission, A. P. Emmert, Warner Gear Co.

Non-Metallic Gearing, F. G. Sorensen, Cincinnati Gear Co., Cincinnati, Ohio.

Inspection, F. G. Eppley, Albaugh-Dover Co., Chicago, Ill.

Commercial Standardization, E. A. Kebler, Fawcus Machine Co.

Industrial Relations, E. S. Sawtelle, Tool Steel Gear and Pinion Co., Cincinnati, Ohio.

Special Committee on New Gear Applications, T. C. Roantree, Westinghouse Electric and Manufacturing Co., East Pittsburgh, Pa.

Membership, W. G. Jones, W. A. Jones Foundry and Machine Co., Chicago, Ill.

Entertainment, C. F. Goedke, William Ganschow Co., Chicago, Ill.

Public Policy, H. E. Eberhardt.

Legal, J. E. Gleason, Gleason Works, Rochester, N. Y.

Metric, J. E. Gleason.

Publicity, J. C. McQuiston, Westinghouse Electric and Manufacturing Co.

The Worm Gear Committee offered for definite criticism data on wheel dimensions, worm dimensions, direction of rotation and thrust, bearing loads, worm radial load, circumferential pressure angles, separating force, wheel radial load, axial pressure angles, normal tooth pressure, pressure per inch of face, and horsepower per revolution.

The Tooth Form Committee in a progress report asked for consideration of the membership of the association of certain points, and it is hoped that the data furnished will enable the proposal of a standard for hobs, so that, regardless of the maker, if they are made standard, gears generated from them should be alike. These points are: Ease-off for the full depth teeth and sub-teeth; fillet radius of top and bottom of hob teeth; the basic rack for 14½- and 20-deg. full-depth involute teeth; the amount to taper generating hobs for spur gears and helical gears.

Proposed recommended practice for differential gears, proposed recommended practice for the inspection of gear cutters (disk) and the inspection of gear shaper cutters, and proposed data sheets of recommended practice for roller transmission chains and sprockets were submitted by the committees having those divisions of the work in charge. Additional data sheets were presented by the Library Committee.

Abstracts of some of the papers will appear in the next issue of the *American Machinist*.

Machinery Manufacturers and Dealers Hold Successful Convention at Atlanta

Seek modification of anti-trust law

The twentieth annual joint convention of the American Supply & Machinery Manufacturers' Association and the Southern Supply & Machinery Dealers' Association was held at the Biltmore Hotel, in Atlanta, Tuesday to Thursday, May 5 to 7, with approximately 600 representative men of the industry in attendance.

Separate meetings were held by the two associations at the opening of the convention Tuesday morning. Tuesday afternoon the initial joint session was held, at which time there was considerable discussion pertaining to resolutions introduced by Dixon C. Williams, seeking the modification of the Sherman anti-trust act, and the ultimate adoption of the resolutions.

"Small Drop Shipment by Express or Parcel Post Direct to Dealers and Customers," comprised another important topic discussed Tuesday afternoon, with Charles W. Beaver and A. B. Weddington, of the General Supply & Machine Co., leading the discussion.

Principal addresses at the Tuesday meeting were by William Staniar, of the E. I. DuPont de Nemours Co., of Wilmington, Del., who spoke at length on the "Relation of Salesmen to Power Transmission"; and by T. C. Keeling, manager of the Nashville Machine & Supply Co., of Nashville, Tenn., who spoke on the topic, "What is Delaying the Standardization of Transmission?"

The principal address at the joint convention Wednesday afternoon was by John C. Ruf, of I. B. Williams & Sons, of Dover, N. H., president of the American association.

In a separate session of the Southern organization Wednesday, addresses were heard on trade topics by J. E. Dilworth, of J. E. Dilworth & Co., Inc.; Lon J. Leary, of the Grinnel Co., Inc.; James Biggs, of the Hardwicks-Etter Co.; and George Winship of the Fulton Supply Co., of Atlanta.

At the joint meetings of the two organizations Wednesday A. C. Kingston presided as chairman, the primary topic discussed being "The Distributor's Responsibility," this discussion led by S. Horace Disston, of Henry Disston & Sons, Inc. Other speakers were W. W. Doe, of the Alabama Machinery & Supply Co., and Frank M. Archer, of the Superior Supply Co.

At Thursday morning's sessions the principal speakers were J. H. McKinnon, W. R. Stevens and R. P. Locket at the meeting of the Southern association, while at the joint session Thursday the speakers were Frederick H. Payne, J. L. Pitts, T. F. Bailey, N. A. Gladding and D. J. Campbell.

John C. Ruf was re-elected president of the American Supply & Machinery Manufacturers' Association at the final meeting on Thursday. Other officers named were W. R. Simpson, of Philadelphia, first vice-president; D. S. Brisbin, of Columbus, Ohio, second vice-president; W. W. Sanderson, of Niagara Falls, N. Y., third vice-president, and Frederick Mitchell, of New York, re-elected secretary and treasurer.

The executive committee was elected as follows: Robert B. Skinner, of New Britain, Conn., chairman; Horace Armstrong, of Chicago; W. C. Henning, of St. Louis; B. O. Payne, of Philadelphia; W. F. Wright, of Lisbon, Ohio.

George Winship, president of the Fulton Supply Co., of Atlanta, was elected president of the Southern Supply & Machinery Dealers' Association. Other officers named were L. J. Larzelere, of the Farquhar Machinery Co., of Jacksonville, Fla., vice-president; Alvin M. Smith, of the Smith-Courtney Co., of Richmond, Va., re-elected secretary and treasurer.

The executive committee was elected as follows: J. L. Pitts, of the Brown-Roberts Hardware and Supply Co., of Alexandria, La., chairman; James Biggs, of Sherman, Tex.; R. M. Williams, of Little Rock, Ark.; and T. C. Keeling, of Nashville, Tenn.

Garvin Machine Co. Passes Into History

The past week has seen the passing of one of the oldest machine tool companies in the country. The Garvin Machine Co. was sold and the plant at Spring and Varick Streets, in downtown New York, is now in process of dismantling.

For upwards of sixty years the Garvin name has been associated with the manufacture of machine tools, and the firm has grown from a small beginning to one of the largest in the market. The company was started in 1856 as a partnership formed by Smith & Garvin, who built a line of milling machines and lathes in a small shop in downtown New York. The business grew and a few years later was moved to what is now Lakewood, N. J.

In 1879 Hugh R. Garvin took control of the company, moved the plant to 139 Center St., New York, and formed a new partnership with his son. The new firm was known as E. E. Garvin & Co., and prospered during the following years. As New York gradually assumed a leading position in the machine tool trade the business of the firm increased and in 1889 it was incorporated as the Garvin Machine Co., and the factory was moved to Canal St. at the corner of Laight St. New lines of tools were added and the company expanded its field during the next few years.

When Hugh Garvin died his son George K. Garvin assumed active management of the concern. In 1896 the plant at Canal St. was destroyed by fire and a new location was secured at Spring and Varick Streets, from which the company now passes. E. E. Garvin died in 1916 and George K. Garvin died in 1919, and the control of the company passed into the hands of Hugh Roy Garvin, who is president of the present organization.

At the auction of the assets of the company, held last week, the following sales were reported: The tapping machine line was purchased by the Western Machine Tool Co., of Holland, Mich.; the duplex drill line by the National Automatic Tool Co., of Richmond, Ind.; screw machines and grinders by J. B. Stevens, Inc., of New Haven, Conn.; the air chuck line by the Skinner Chuck Co., New Britain, Conn.; duplex milling machines by Joseph H. Beals & Co., Boston, Mass.; plain and universal milling machines by H. Leach, of Providence, R. I. George H. Frew Jr. will take over the hand milling machines, cam cutters, profilers and air cylinders, and will be located for the present at 139 Varick St.

W. H. Rastall Urges Machine Tool Builders to Cultivate and Develop Foreign Markets

Present is favorable time for such an effort

The following is an abstract of an address made by W. H. Rastall, chief of the Industrial Division of the Bureau of Foreign and Domestic Commerce, before the recent meeting of the National Machine Tool Builders Association at Buffalo, N. Y.

"The statistics covering the exports of metal-working machinery in 1924 have just become available. As plotted on a diagram, these returns are comparatively inconspicuous because they are overshadowed by the immense volume of foreign business you secured during the war period and the post-armistice period. But if we will disregard the huge volume of those years, the returns become quite encouraging. Considering only the experience of the past three years, it is to be noted that this business has expanded 20 per cent. There is also great reason for encouragement in the distribution of these shipments. The volume to Europe has expanded from $3,900,000 in 1922 to $7,350,000 in 1924.

"It is difficult to discuss a subject of this kind before a group representing so many different styles of machinery. Those of you who manufacture the higher class of production tools will, obviously, find your best market in the manufacturing countries of Europe, and the expansion indicated by the figures just reported should be a matter of great encouragement to those of you who produce these tools. On the other hand, those who are engaged in the production of what might be called "general service tools" will probably find it difficult to market such equipment in Europe and will find your greatest interest in the countries of Asia, Latin America, etc., and it is most interesting to study the tendencies of the trade in these areas, for in the pre-war period Asia took less than three per cent of our exports of metal-working machinery, while, in 1924, the participation was in excess of 17 per cent. Similarly, in 1913, Latin America took 5 per cent of these exports of metal-working machinery, while, in 1924, the volume was 12.6 per cent. In discussing export matters with the machinery builders of this country, there is a tendency to think of export as shipments to Europe. Quite frequently we meet with the thought that a given manufacturer will not give much attention to export at present because conditions "Over There" are not good. The "Over There" obviously refers to Europe, but it should be emphasized that the volume of business to Asia, Latin America, and other parts of the world is most important.

"An analysis of the shipments to individual countries reveals that in certain areas the volume of business has decreased greatly. For example, in British India the volume in 1922 at $2,400,000 has declined until in 1924 it is $337,000. There is a suggestion that this represents a failure on the part of the American machine tool manufacturer to support his products in that market with adequate salesmanship.

"Which of you has proper sales representation in India? It is probably safe to say that since the Armistice India has absorbed more than $50,000,000 worth of metal-working machinery. One is forced to the conclusion that your interests are not adequately represented in that area. Your business with Canada has decreased from $2,956,000 in 1923 to $1,751,000 in 1924. You are so close to that market that you will be able to provide your own explanations.

"On the other hand, a very gratifying expansion has developed in many of your most important markets. Shipments to the United Kingdom have increased $1,000,000 since 1922. Shipments to France have shown a like increase. Shipments to Germany were interrupted by the war and during the post-Armistice period were prevented by various embargoes. These embargoes were lifted in 1924 and the volume shipped to that country was in excess of half a million dollars. Russia has suddenly absorbed over $220,000 worth of metal-working machinery.

"At the last convention, figures were submitted in an effort to show the comparative effectiveness of the organizations marketing metal-working machinery on behalf of the manufacturers of the United States, Great Britain and Germany. There has been considerable discussion of this subject since that meeting, but it is probably safe to say that today the machine tool industry of the United States is operating at about 40 per cent of capacity. Of this 40 per cent, approximately 20 per cent is being exported.

The present is a very favorable time to make such efforts. For example, business with Germany has been interrupted for ten years and all of the old agency arrangements have probably lapsed. In one way or another it is necessary to revive this business.

"In this connection it is desirable to repeat the suggestion just made by Mr. Meyer, to the effect that you consider the desirability of forming groups for work in the various markets. If you can gather together half a dozen manufacturers of non-competitive machinery and arrange to place your agencies jointly, you will find that it will facilitate your operation in foreign markets and when the time comes that you wish to send a representative to the field or to co-operate with your dealers, it will be much cheaper because several interests can divide the cost. There are many other ways in which this suggestion of Mr. Meyer's is valuable and I would like to support his recommendation for your further consideration."

Prominent Engineers Lost in River Disaster

Latest reports coming from Memphis state that a total of seventeen prominent members of the engineering profession were lost in the capsizing and sinking of the government excursion steamer "Norman" in the Mississippi River late in the afternoon of May 8. The list of the missing includes Paul Norcross, consulting engineer, of Atlanta; Major W. M. Gardiner, civil engineer in charge of revetment work at Cow Island; Major C. H. Miller, consulting engineer, of Little Rock; C. E. Shearer, consulting engineer, of Memphis; Ralph Bosard, of the Morgan Engineering Co.; T. W. Fox, of the Public Utility Co., Paducah; E. H. Bowser, Illinois Central R.R.; G. L. Anderson of Ayes & Miller, Memphis; Prof. Walter Kirkpatrick, University of Mississippi; William Hannum, Phœnix Utility Co., Memphis; Prof. R. H. McNeilly, Vanderbilt University.

Notes of Washington Activities

By Paul Wooton

The trend of immigration policy is responsible more than any other one thing for a resort to machinery to an extent never before approached in America. An opinion to this effect is based on the observation of government specialists in many lines, who traveling about the country in the discharge of their duties come in close contact with all lines of endeavor. The consensus of their thought is that we are on the threshhold of a new era of mechanical development. Their observations strengthen the belief that the excess capacity in some machinery manufacturing industries, during the war, soon will be needed. The machinery specialist who analyzed these reports is of the opinion that demand will overtake our capacity sooner than most manufacturers think.

The aggregate of all production in the United States is now 30 per cent greater than the pre-war rate. Population increase accounts for only 15 per cent of that amount. The remainder results from increased efficiency. Since the productivity of labor itself is no higher, and probably is lower, than before the war, it is agreed that machinery is principally responsible for the increased rate of production, an honor which is shared, however, with improved processes.

Products in the so-called luxury class contribute largely to the increase. The per capita expenditures for such articles as automobiles, radio sets, better and more furniture have increased greatly, but apparently the people are becoming more provident because saving accounts are proportionately greater than they were before the war. Investments in life insurance are heavier. The per capita absorbing power for securities is higher. For nearly a decade the American people have had at their disposal more funds than ever before. It is regarded as a tribute to their sanity and balance that instead of wasting their substance the trend is in the opposite direction.

Business Items

The Consolidated Machine Tool Corporation of America with general offices at Rochester, N. Y., announce the removal of their New York district sales office to a more convenient downtown location. Formerly located at No. 17 East 42nd St., the new address is No. 150 Broadway, Westinghouse Building.

The Consolidated Plants are now located as follows: Betts Works, Colburn Works and Newton Works at Rochester, N. Y.; Hilles & Jones Works at Wilmington, Delaware; and the Modern Works at Erie, Pennsylvania.

The Blair Tool & Machine Co., of New York, announces the following changes in personnel, due to the recent death of Mr. Potter, the former owner. Robert A. Bachman, formerly vice-president and general manager of the Edison laboratories in New Jersey, has been appointed general manager. James E. Engle, formerly in charge of the production and jobbing department of the Garvin Machine Co., has been appointed chief engineer in charge of production. William J. Grauer, formerly with R. Hoe & Co., has been appointed general shop superintendent.

The Sullivan Machinery Co. announces that its office at Dallas, Texas, has been removed from the Western Indemnity Building, to Rooms 522-523, Sante Fe Building. Complete stocks are carried and quick service is promised. This office is in charge of David H. Hunter.

The Foote Bros. Gear & Machine Co., of Chicago, Ill., announce that they are now represented in Duluth and the surrounding territory by the Arrowhead Sales Co., 227 Wabasha Street.

The Gardner Tap & Die Co., 1878 E. Eighteenth St., Cleveland, announce that they have secured the services of the E. H. Welker Co., Inc., 222 W. Larned St., Detroit, to handle their line of taps, dies, screw plates and threading tools in lower peninsula of Michigan. C. H. Stephens, of the Welker company will devote his time to the Gardner line.

The Westinghouse Electric & Manufacturing Co., of East Pittsburgh, Pa., announces that the office of the president of that company has been located permanently at 150 Broadway, New York City.

The King's County Iron Foundry, Inc., Brooklyn, N. Y., has purchased the two plants at Stamford, Conn., formerly operated by the H. & G. Foundry Co., from the Fairfield Holding Corporation.

William Laidlaw, who has been treasurer and manager of the Clark Tool Works, Inc., of Belmont, N. Y., for the past five years, has purchased the business and a newly organized corporation, William Laidlaw, Inc., took over the business on May 1. The new organization will continue the manufacture of metal cutting band saws and special machinery. Mr. Laidlaw will have associated with him at Belmont, W. Lorimer Martwick, of New York City, as vice-president; Eldyn V. Champlin as secretary, and C. K. Laidlaw as treasurer.

The Clark Tool Works, Inc. was organized ten years ago by W. P. Clark, one of the founders of Clark Bros. Co. manufacturers of saw mill machinery, formerly of Belmont and now of Olean, N. Y. Mr. Laidlaw was at one time connected with Clark Bros. Co. in charge of their machine department. He was also with the Northern Electrical Mfg. Co. of Madison, Wis. for several years and later with the General Electric Company. In 1908 he quit the manufacturing business to enter the field of public utilities in Illinois and later in Colorado.

In 1917 Mr. Laidlaw sold his property in Colorado and volunteered his services and entered the military service at Ft. Riley, Kan. When the 89th Division was organized he was commissioned a captain and assigned to the 342nd Machine Gun Battalion with which organization he served overseas. On his return from Europe in the fall of 1919 he accepted the position of general manager of the Clark Tool Works, Inc. where he has been since that time.

The General Die Castings & Machinery Co., of Chicago, will move to Benton Harbor, where it will be merged with the Benton Harbor Malleable Co.

The plant of the Victor Saw Works on Rowland Avenue, Springfield, Mass., has been bought by James L. Shannon, manufacturer of brass and steel novelties. Mr. Shannon is principal owner of the Blake Manufacturing Co., and also owns the James L. Shannon Co. plant at 356 Worthington Street. The Blake Company will remove its business from its present plant on Taylor St. to the Victor Saw Works plant.

The Industrial Works, Bay City, Mich., manufacturers of locomotive cranes and crane equipment, announce the opening of two new district offices, one at 425 Whitney Central Building, New Orleans, La., in charge of John A. Abele, district sales manager; and the other at 843-A Hurt Building, Atlanta, Ga., in charge of John J. Murphy, district sales manager. The company also announces the appointment of four additional district sales engineers: Douglas J. Calder, Conway J. Neacy and Monroe J. Frankel will have offices at the Chicago district office of the company, 1051 McCormick Building, and Chester F. Delbridge will be located at the St. Louis district office, Railway Exchange Building.

The Reliance Machine & Tool Company has opened a plant at 1141 West Thirtieth Street, Indianapolis.

The Roller-Smith Co., 233 Broadway, New York, announces the appointment of the Detweiler-Bell Co., 101 Milk St., Boston, Mass., and 152 Temple St., New Haven, Conn., as its representative in the States of Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island. Having offices both in Boston and New Haven the Detweiler-Bell Co. is in an excellent position to handle the Roller-Smith Co.'s line of electrical measuring instruments and circuit breakers in the entire New England territory. The personnel of the Detweiler-Bell Co. consists of Paul G. Detweiler, who is in charge of the New Haven office, and R. H. McCormick, who is in charge of the Boston office. The Detweiler-Bell Co. succeeds Walter W. Gaskill, who has been representing the Roller-Smith Co. in the New England territory for several years.

At the annual meeting of the Williams Foundry & Machine Co., Akron, J. K. Williams was elected president; H. L. Williams vice-president and treasurer; F. C. Vandergrift, secretary and general manager, to succeed the late Christian Frantz. These officers with Charles B. Raymond and F. E. Holcomb constitute the board of directors.

Directors of the Youngstown Sheet & Tube Co., Youngstown, Ohio, at their reorganization meeting following the annual election of stockholders, re-elected J. A. Campbell president for the twenty-second year. This is believed to be a record for such a position, especially for one who organized and developed so great a property.

The board elected W. J. Morris, who has been treasurer and assistant secretary, vice-president in charge of finances and accounting. W. E. Meub, who has been secretary and assistant treasurer, was elected secretary-treasurer of the company, and R. M. Welsh, assistant treasurer, was named assistant secretary-treasurer.

Announcement has been made that the Baltimore Valve Co., Sinclair Lane and Patterson Park Ave., Baltimore, Md., will begin operations under new management, the plant having been acquired by interests headed by W. F. Peterson. The company will be known as the Baltimore Valve Corporation and is reported to be financed by Baltimore and Milwaukee capital. Mr. Peterson is president; Julian H. Marshall, vice-president and treasurer, and Frederick W. Brune secretary.

The Southern Bearings Co., of Atlanta, one of the largest automotive parts distributors in the South, has removed to larger quarters at 449 Peachtree St. The former address was 375 Edgewood Ave. for some years. Robert M. Schnore, president of the company, is a director in the South for the National Standard Parts Association, and chairman of the membership committee.

Davis & Thompson, of Milwaukee, Wis., are concentrating their former two plants in one of greatly increased capacity, in the buildings formerly occupied by the Avery Company, located at Mitchell and 57th Streets.

The National Cast Iron Pipe Co., of Birmingham, Ala., has increased the capital stock from $500,000 to $1,000,000, for further expansion of the company's Birmingham factories. Within the past several months several hundred thousand dollars has been invested by this company enlarging the shop facilities at Birmingham.

The annual meeting of the stockholders of the Diebold Safe and Lock Co. of Canton, Ohio, was held recently and Charles C. Upham, president and general manager, was re-elected. A. J. Roos, was named first vice-president and treasurer; H. C. Weible, secretary; J. L. Criswell, vice-president and general manager of sales; J. A. Fellows, vice-president in charge of operations; W. C. Miller, vice-president in charge of burglar-proof sales; H. A. Noble, vice-president in charge of fireproof sales.

The Halden Manufacturing Co., manufacturers of automobile shock absorbers, has completed the removal of its factory equipment from Watertown, Conn., to Thomaston, Conn. Employment is now given to twenty machinists and plans contemplate expansion of operations.

The 94th annual exposition of inventions by the American Institute of the City of New York, was held on April 27th to May 2nd, in the Engineering Societies Building, 33 West 39th Street, New York City. Many exhibitions were displayed by inventors and by concerns who have developed patentable features and ideas. Electrical, mechanical and labor saving devices of unique design were shown, and demonstrations were made of the advancement that has been made in this field.

The Morency-Van Buren Manufacturing Co., Sturgis, Mich., a $1,000,000 concern, has been sold to the Scovil Manufacturing Co., Waterbury, Conn.

The M. & N. Valve Corporation was organized at Anniston, Ala., this month with $175,000 capital, and will start at once the establishment there of a large plant to include foundries and shops, for the manufacture of valves and fittings. J. W. Conway was elected president of the company. At the outset, he advises, the plant will employ about 300 workers.

The Danbury Iron Works Co., of Danbury, Conn., has increased its capitalization to $25,000 and is offering 8 per cent preferred.

The R. J. Tower Iron Works, Greenville, Mich., has announced the purchase of the Taplin Furnace Co., Grand Rapids, Mich., manufacturer of the Taplin hot blast furnace. Neal W. Taplin, manager of the Grand Rapids plant, will head the sales department of the new concern, which will be known as the Taplin Furnace Co.

The Smith & Ferguson Co. has been organized at Richland Center, Wis., to operate a general machine shop, repair works, and do custom designing. La Verne Smith, formerly of West Salem, Wis., is president.

The Wells Corporation, Greenfield, Mass., that has been in the hands of the receiver, Charles H. Keith, for more than a year, will be sold at public auction May 8. The receiver will sell the interests and equity, and the Franklin County Trust Co., holder of a mortgage on the real estate in Greenfield and Williamsburg, Mass., will hold a foreclosure sale.

The Charles Parker Co., manufacturers of hardware at Meriden, Conn., has increased its directorate by the election of L. C. Parker, Charles Parker and E. P. Lyon to the board. William H. Lyon, who was secretary-treasurer of the company, has been elected president to succeed Dexter Parker, deceased. William R. Bannister was elected treasurer and Charles S. Parker was elected secretary. Wilbur F. Parker continues as vice-president.

Personals

K. H. HALS, formerly associated with the Northern Machinery Co., as vice-president, has joined the sales organization of the Wescott Chuck Co., of Oneida, N. Y.

CHARLES A. WIDMER, formerly associated with the Providence Engineering Corporation, of Providence, R. I., has joined the sales staff of Vandyck Churchill Co., of 52 Vesey St., New York.

JOHN W. CARLETON has retired from active management of the plant of the Union Manufacturing Co., of New Britain, Conn., but will continue with the organization in an advisory capacity. George Bush has been appointed plant manager.

W. C. HILL, of Lufkin, Tex., was elected president of the Southern Metal Trades Association for the coming year at the annual convention held the latter part of April at San Antonio, Tex. Other officers named were George B. Coker, of Gastonia, N. C., vice-president, and W. E. Dunn, Jr., of Atlanta, re-elected executive secretary and treasurer.

The program during the two days of the convention was one of the most ambitious the association had ever carried out, including addresses by well-known industrial men and officials of several of the larger metal trades plants. Macon, Ga., was selected for the 1926 convention, plans for which are already under way.

COL. E. A. DEEDS, of Dayton, Ohio, has been selected to fill the position as chairman of the executive committee of the Niles-Bement-Pond Co. The announcement carries the information that Col. Deeds will have absolute control of the company.

CHAUNCEY A. WILLIAMS, of Manchester, N. H., has purchased the Page Needle Co., of Chicopee Falls, Mass., manufacturers of needles and employing 150 hands. The Chauncey A. Williams interests now control three of the largest needle manufactories in New England and are part owners of two other concerns.

ARTHUR W. LAMSON, vice-president and works manager of the Wico Electric Co., of West Springfield, has resigned but will retain his interest in the company and remain on the board of directors. He has been connected with the company for fifteen years. The company specializes on magnetos, its product being valued at over $150,000 monthly.

W. F. CUTLER, president of the Southern Car Wheel Company, and G. M. P. Murphy, New York financier and director of the Bethlehem Steel Corporation, were elected directors of the Standard Tank Car Company, Youngstown, Ohio, at a recent meeting of stockholders. They succeed H. C. Rorick, Toledo, and R. F. Holmes, Pittsburgh, both of whom resigned.

The reorganization of the company under the new management became effective May 1. The new board will meet soon to elect officers.

L. R. HODGE has beeen appointed factory service manager of the Franklin Automobile Co., Syracuse, N. Y.

M. B. GIBERSON, SR., has been elected manager and president of the new Chelsea Foundry Co., Chelsea, Michigan.

LEIGH LYNCH, for the last six years with the Fisher Body Corp. and for the past two years general manager of the Pontiac division of that company, has been named vice-president of Cram & Hawley, financial and industrial specialists, with offices in the new Buhl Building, Detroit.

CHARLES E. NORTON and JOHN R. WHEELER, of the Standard Machinery Co., are interested in the newly organized Textile Rubber Co., organized at Mystic, Conn. The Standard Machinery Co., manufactures machinery for the rubber manufacturing industry. The product of the new company will be known under the trade name of "San Tex."

RALPH E. WORKMAN has been appointed general manager of the Genesse-Flint Co., Flint, Mich., which was formerly known as the Flint Motor Co.

JOHN W. LEGGAT, former service engineer of the Gray Motor Corp., has been appointed service manager.

ELMER W. JONES, Marquette, Mich., has been elected president of the Chartiers Mining Manufacturing Co.

LEONARD J. A. SMIT, member of the firm of Anton Smit & Company, of Antwerp, Belgium, has arrived in this country. Mr. Smit's visit is in the interests of his organization, which is one of the largest foreign manufacturers of industrial diamonds and carbons. While in the country Mr. Smit will appoint several local agents for his firm. His address will be at 15 Moore St., New York City, care of the Selma Mercantile Corporation.

The Business Barometer

This week's outlook in Commerce, Finance, Agriculture and Industry based on current developments

By Theodore H. Price
Editor, *Commerce and Finance, New York*

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"BEHOLD how great a matter a little fire kindleth"—if it be well advertised—is a thought that must frequently occur to all students of business in the United States.

The overall parade of 1920 included less than 200 people, but it was widely exploited in the newspapers; it was followed by a sensational decline in silk, and the so-called buyers' strike which ensued was generally attributed to it.

So it is now. The stories about the personal economies of President Coolidge have been contradicted, and there can be no doubt that they are apocryphal, but they are being widely advertised by those who protest against them and it is not improbable that they have made retail buyers more discriminatory.

The fact is that people are eager to seize upon any pretext for economy whenever they become conscious that their expenses are pressing upon their incomes, and what is happening now is simply an example of auto-suggestion. Fortunately no one will be much hurt, for the hand to mouth buying in which retailers have so long persisted has kept their stocks low and most manufacturers have been curtailing for some time in an effort to bring production within the limits of the demand.

Therefore it appears unlikely that a general decline in prices will cause any serious losses and that it must and will ultimately bring about a marked gain in consumption, and a great increase in industrial activity is conceded by all those who believe in the law of supply and demand.

Upon this latter theory the stock market was firm and higher last week. It is discounting possibility through lower commodity prices and a further advance seems probable as long as money continues cheap. And there is nothing immediately in sight to put money rates up before fall, when the usual seasonal firmness may appear.

The same thing may be said of bonds, and especially municipal bonds, of which there appears to be a dearth despite the large issues with which the market has been supplied during the last twelve months.

But in counting upon a continued advance in the security market, sight should not be lost of the fact that none of the much talked of railway consolidations has as yet been approved by the Interstate Commerce Commission; that it is unlikely that the Commission will act before Congress convenes and that in the interval we may have a vociferous demand for lower freight rates if commodities continue to decline.

As to this last "if," of a continued decline in commodity values it is hard to speak definitely. In a recently published advertisement it was announced that more than $30,000,000 a year was spent for paper drinking cups in the United States, and a New York department store claims to have sold more than $1,000,000 of radios and radio equipment in a single day last week.

The "economic slack" that can be taken up or released at will in this country is in fact so great that it is hard to be clear visioned and dangerous to be dogmatic in regard to the future of prices. That future is as much a matter of psychology as it is of mathematics.

But as a generalization it seems safe to assume that America's buying public is in a mood to insist upon lower prices for things that are or have been abnormally high. Wool, coffee and rubber are three articles that are or have been recently within what may be described as the high priced class. Great deliberation in buying is expected.

As to rubber, all that can be said is that, justly or unjustly, America will resent any further advance in the artificially controlled market for a product of which this country is the chief consumer.

The other major commodities are midway between abnormally high and abnormally low prices. The weather and the crop outlook will govern in the case of grain and cotton. Last week the former went up and the latter down. Those who can guess the rainfall and sunshine will be able to make money by trading in wheat, corn and cotton during the next three months. Hogs and provisions have recovered, the outlook for cattle prices is excellent and hides are firm, but there is strong price resistance in all these markets.

The distributive trade of the country is about up to the average, but it is not exciting. The automobile manufacturers have reached their seasonal peak and the silk industry still operates at a high level, but there is small comfort in such facts for the makers of what used to be called the staple commodities. Iron and steel production is declining rather sharply and the business in all the metals reflects the lessened building activity that is likely to continue until bricklayers, steamfitters, etc., can be hired at less than $10 or $15 a day.

Conditions abroad need no special exposition. From the American business man's standpoint they are presently satisfactory, but there is much misgiving as to whether Caillaux or anyone else can lift the French government out of the financial quicksands in which it was until recently sinking. During the summer the rate of franc exchange will be bolstered by the expenditures of our tourists in France, but unless Caillaux can persuade the French people to pay higher taxes and buy government bonds again the action of the franc after the tourist season dies down must be looked to with misgiving.

What's Doing in Industry

The first two weeks of May brought about a stabilization of buying that had been characterized by many as depression. That this was a false idea is proven by the general condition that has become apparent as the month grows older.

Buying has not been up to expectations in many lines, but the machinery and machine tool lines have not suffered as have some other industries. Analysis of the reports received from the various machinery centers gives us the impression that business is "spotty" —a condition not altogether unsatisfactory because the orders now on the books come from every corner of the country, which is a sign of widespread activity in trades that patronize the industry. Also, diversified types of machines are being sought. While the railroads have not responded to market offerings as they had been expected to, the automotive field has been quite active and most of the business being done now is in this channel. The order of the day is for more production at less cost and for less expenditure, and machines that assure these two things are finding a market in the automobile industry.

Employment is satisfactory, no further recessions in schedules being reported and increases in more than one section being made in the past week.

The Industrial Review

Progress of the machinery and machine-tool business in various parts of the country

THE following reports gathered from the various machinery and machine tool centers of the country, indicate the trend of business in these industries and what may be expected from the future:

Philadelphia

At the beginning of the present month the demand for machinery and tools throughout the Philadelphia district was somewhat improved over what it was a month before. The situation remains uncertain, however, and the business is best described as spotty.

Inquiries are few, and give little promise of early quantity buying. In the iron and steel industry there has been a subsidence of demand and a weakening of prices.

In spite of this, however, there has been an increase in employment and wages in some lines in the states included in the Third Federal Reserve District. Car repair shops and structural iron works each reported increases of more than 5 per cent in working forces, while iron and steel forging plants showed declines.

Off-setting this, some industries reported reductions in wage payments, the largest being 11.6 per cent. Out of a total of thirty-seven industries engaged in the production of machines and machine tools, the number of employees showed 9,438, a decrease of 0.4 per cent over the preceding month.

Southern District

The last week of April noted some improvement in machine tool and equipment demand in the Southern district, dealers reporting total sales for the month better than in April last year.

Good sales of heavy tools are reported by larger dealers to the Southern railroads the past two weeks, with inquiries from this source showing no signs of abatement. Several new shop projects were announced by Southern roads during the month, chief of which is a $500,000 program at Waycross, Ga., by the Atlantic Coast Line, of which about $400,000 will be for shops.

Rebuilt and second-hand tools have continued in active demand from automotive service stations the past two weeks, though the smaller machine shops are not very active in the market at this time. Sales to service stations and garages in the South this year, January to April inclusive, have attained one of the highest records of the past ten years, exceeding the corresponding period of either last year or the year before by approximately 15 to 20 per cent.

Three large jobbers in Atlanta, handling automotive parts, state that their sales so far this year are 20 to 25 per cent better than last season up to this time, and that 1925 business will undoubtedly be the largest they have ever experienced.

Textile and lumber industries are also reported more active in the machinery market, with inquiries sufficiently heavy to insure good sales in these markets the next two months. The former industry is buying on a much heavier basis than in several months.

New industrial construction continued unusually active in the South through April, and good inquiries from this source are reported, primarily lumber, textile, furniture plants in the Carolinas, foundry and machine shop plants in Tennessee, Alabama and North Carolina, and garages and service stations in all parts of the South.

The cotton acreage is larger than had been anticipated, exceeding last year by about 5 per cent, and with prices holding to a stable basis this fact is giving Southern business a better feeling and generally helping business conditions.

Cincinnati

Machine tool manufacturers of Cincinnati report that April's gradual increase of demand has continued into May and state that, taking all things into consideration, they regard the outlook as decidedly encouraging. Machine tool dealers also report some increase in sales, but they still find the market somewhat backward and more sluggish than it should be.

A manufacturer who has just sold a number of large tools to two different railroads, and also several tools to industrial plants in different sections of the country, regards this as good grounds for optimism. Besides these orders, he stated, inquiries are coming in from all parts of the country, most of them being from the West, however, and that section is placing the greatest number of orders.

The majority of manufacturers report that business is well scattered and that orders are diversified, which is regarded as a wholesome state of affairs. Concerns in the automotive industries are still buying, although under ordinary circumstances their period of purchasing machine tools closes before this time.

The demand from the electrical field has decreased somewhat, except that from radio manufacturers, who continue to be busy. The demand for agricultural instruments is reported to be increasing, and it is thought that this will result in at least a few orders for tools.

Increased activity in the pig iron market is regarded as a very favorable sign. Local manufacturers in various lines report increased sales here and also a better demand from all parts of the country.

There is a general feeling that prices have become stabilized, and there is less selling resistance than there was because of the fact that prospective buyers were holding off until the market reached the bottom. As a matter of fact, it is expected that prices will have a tendency upward, as soon as the demand begins to approach a normal state.

Chicago

Practically no change in the Chicago machine tool market has been noted during the last week. Dealers, with scarcely an exception, say that inquiries are not what they have been hoping for in view of the published reports that industry is reviving throughout the Middle West, and production increasing. They are still expectant, however, of a change in the situation for the better before the season advances into summer, and are counting on a demand for tools which will be needed when normal production is resumed. Dealers in wood-working machinery report little variation from the business done during March and April, and are looking forward to the completion of new technical schools now under construction by the Chicago Board of Education as affording a prospective opportunity to put in some worth while bids on the equipment these schools will require.

So far as known, railroad inquiries are about at an end for the present, although the Santa Fe and Illinois Central roads are still making desultory inquiries for special machine tools. Among the recent orders placed by the Board of Education was one for twenty-four 14-inch lathes for the technical department of one of the city's high schools. The Link Belt Co. this week made an important real estate deal with a view to the enlargement of its plant on Pershing Road. This was the purchase of an adjoining property with a ground space of 280 x 560 ft., the cost being approximately $500,000.

Indianapolis

Virtually no change can be reported either in machinery or tool business in this territory. Spottiness prevails, some industries apparently doing a good volume of business and buying accordingly and others being far "off color." Even in certain general classifications of business, the situation is very spotted.

For instance, the automobile business: Two Indianapolis automobile factories have a sufficient number of or-

ders to increase production. The same is true of another large automobile company in Indiana. The others have curtailed production slightly and are not buying. Business with the farm implement factories at South Bend and Evansville, where most of them are located, is good. Officials of these plants predict a much better year than last and are buying accordingly. Most of the Indiana plants are working at capacity and in some instances extra shifts are necessary.

A larger number of inquiries for tools and machinery is being received from railroads, but actual orders are few. It is believed here that this business will pick up before the end of the summer.

Contrasted with the automobile situation, is the uniformly steady buying from accessory plants in this state. Most of these plants are busy and, while orders are small, they are sufficiently frequent to keep the volume up to a respectable size. Another source of sale which promises to better last year's business is the road machinery business. Indiana this year will construct many more miles both of hard surface and secondary roads than last year, and contractors are easily sold.

Dealers in second-hand machinery report a good volume. The available supply of used machinery has shrunk until it sometimes is difficult to fill orders.

Detroit

A survey of the machinery and machine tool representatives in Detroit indicates that business at the present time is at the highest point it has reached this year.

The condition can be traced directly to the steady increase in automobile production. While the year opened with things moving along quietly, the machinery field found itself with little hope for larger activity until the automotive plants should approach peak production. The past two months have witnessed a steady increase in output, with a corresponding activity in all lines of business affected by the principal industry in Detroit.

Outstanding among the events of the week of interest to machine tool and machinery men was the announcement that the Wilson Foundry and Machine Co., of Pontiac, will expend more than $2,000,000 within the next 90 days for new buildings and equipment. This expansion is to provide an assembly plant for Knight motors for the Willys-Overland Co., of Toledo. It involves a four-story factory unit, 100 x 400 ft. and four stories, as well as additions to other units of the plant, totalling 172,000 sq.ft. All machinery and equipment necessary to assemble the motors will be purchased and installed in the new units which will be ready for occupancy by Oct. 1. The occasion for the expenditure of two million is the placing of an order this week for 4,500 engines for Federal-Knight trucks. The order itself involves approximately $1,500,000.

Of hardly less importance from the standpoint of the motor car industry was the announcement that the closed car plant of the Buick Motor Co. which has been located in Detroit, will be transferred to Flint. The consolidation of the Buick factories will mean an increase in production at Flint of about 250 cars daily. Factories Nos. 6, 7 and 10 at Flint are being rearranged to absorb the closed car factory. All machinery and tools used in the Detroit plant will be removed to Flint, although some will be replaced.

A furnace and machine foundry will be installed at once in the Iron Mountain, Mich., plant of the Ford Motor Co. The blast furnace, which is to be of 100-ton capacity, is to be adapted to the charcoal process of making iron.

The Martin-Parry Corp., of York, Pa., auto truck body manufacturers, has leased the Flint factories of the Dort Motor Car Co. The Corporation's Flint plant was destroyed by fire recently with a loss of $200,000. While it is being rebuilt the Dort factories will be utilized.

Negotiations are under way which may lead to the removal of the Curtiss Aeroplane and Motor Co. plant from Buffalo to Detroit. The Stout Metal Airplane Co., whose factory is located at the Ford Airdome, is planning to install machinery for quantity production.

For the twelfth consecutive week employment in the 79 automobile plants and automobile accessories factories of Detroit showed a substantial increase according to figures of the Detroit Employers' Association. The increase last week of 4,489 brought the total up to 236,557, within a few thousand of the high-water mark in employment reached a little over a year ago.

New York

General conditions in the local market have not changed materially during the past fortnight. Buying of machine tools is not up to expectations but the volume of business done the first half of this month would seem to indicate that May will exceed April in total sales.

It is no secret that the New York market was rather inactive during April, but sales of small tools and supplies have been quite satisfactory the first two weeks in May.

The railroads, which have provided one of the best outlets for machines in this market, have done very little business of late. Small orders for one or two pieces have been received by some firms, but there has been no placing of large orders for shop equipment.

The automotive field has offered dealers and manufacturers the greatest opportunity for the disposal of stocks. Increased activity in the automobile world has led to the demand for machines that cut down time and guarantee more and better production. Automobile manufacturers have also been in the market for small tools and this has helped to swell the total volume of sales.

Unlike the railroads, the automotive industry is quick in deciding what machinery it wants and then is just as quick in buying it once it has been located.

A noticeable betterment has come over the foreign market in the past two weeks. While the orders received from abroad are not written in large figures, they are nevertheless indicative of increased industrial activity on the continent and are taken as good signs for future business. England is active and has taken several fair orders, but Germany is the best customer right now. France, due probably to the unsettled political conditions, has not been expanding along industrial lines and has been rather backward in making purchases.

One of the most encouraging reports from the New York market is to the effect that a prominent Western manufacturer has done a remarkable business abroad with a certain type of internal grinding machine that has evidently found great favor among foreign buyers. It is reported that this machine has outsold all others and that orders for additional machines are under way.

It is expected that the next few weeks will see some action one way or another on the lists issued some time ago by big railroads that have their purchasing offices in New York. This should have an important bearing on future business.

New England

Germany and England are the big buyers of machinery from manufacturers in the New England territory at the present time with the weight of buying in Germany's favor. Rapid strides for industrial recovery in Germany are apparently being made, in the opinion of manufacturers here and business prospects are favorable for even greater volume of business. The preponderance of buying by German industrial organizations was the subject of comment by builders of automatic machines, also by those turning out drills, punch presses and small tools. Japan is also a good customer at the present time. Business with France has stopped and accounting for this manufacturers point to the uncertain political situation. Trade with Italy is also ebbing.

Manufacturers of automotive machinery report business has shown an improvement in the past week and the sales manager of a principal corporation reports that 90 per cent of its business at the present time is for the automotive industry.

On the other hand a Hartford company, manufacturing drill and press machinery, having an extensive market in the automobile world, reports its present business for this industry is mediocre, although during the first three months of this year the demands were of large volume. Electrical manufacturers and makers of radios and automobile parts are producing a fair volume of orders.

The electrical industry is mentioned by Hartford and Worcester manufacturers as giving substantial business at the present time.

The trade at the present time is in a hesitating mood and business has to be brought out, but the concensus of manufacturers is hopeful for better conditions. Different manufacturers report intention of keeping on present working forces because business in prospect is encouraging.

Obituaries

HORACE K. JONES, aged 83, died at his home in Hartford, Conn., on May 5. He was consulting mechanical expert for the Corbin Screw Corporation, New Britain, and despite his advanced years commuted daily between Hartford and New Britain, having a record of fifty years commuting. Over 100 patents had been granted him for machinery and parts for the manufacture of wood screws.

WILLIAM WALLACE WOOD, age sixty-two, regarded as a railroad airbrake authority, died recently at Lafayette, Indiana, following a long illness. For many years Mr. Wood was an airbrake instructor on the Monon railroad. He was nationally known and was the author of "Wood's Westinghouse T-T Airbrake Instruction Pocketbook" and also the "Walschaert Locomotive Valve Gear," both books gaining him wide recognition.

WILLIAM F. MARSHALL, member of the firm of Marshall & Meier, of 298 Mulberry St., New York, died on April 26.

JOHN J. HEYS, general manager of the Beverly (Mass.) factories of the United Shoe Machinery Company for several years, died May 3 at his home, 45 Nahant St., Lynn, Mass. Mr. Heys was born in Wolverhampton, Eng., in 1861, and served his apprenticeship with the English & American Shoe Machinery Company. He came to Lynn in 1883, and was employed by Maurice V. Bresnahan & Co. In 1901 he became general manager of the newly incorporated Bresnahan Shoe Machinery Company. Later when Thomas G. Plant became a majority stockholder, Mr. Heys was elected president. This connection he held until 15 years ago when he was made general manager of the United Shoe Machinery Company. Mr. Heys was prominent in many clubs and in fraternal circles.

FREDERICK W. H. CRANE, who retired three years ago as president of the Robert Hoe Press Manufacturing Company, died at the age of 80 at his home in Brooklyn, N. Y. He was the father of Judge Frederick E. Crane of the Court of Appeals at Albany, N. Y.

Mr. Crane was a native of Old Saybrook, Conn., and was a close friend of the late Robert Hoe, and was the executor of his large estate.

FRANK TRANSUE, for many years identified with the steel industry, died recently at his home in Alliance, Ohio. He was organizer of the Transue-Williams Co., now the Transue-Williams Steel Forging Corporation, and at the time of his death was vice-president of that organization, vice-president of the Buckeye Jack Co., and was identified with a number of other Alliance industries.

HARRY S. HUNTER, founder and president of the Hunter Saw & Machine Co., of Pittsburgh, died at Cambridge Springs on May 7. In our next issue will be published a detailed account of Mr. Hunter's association with the machinery industry.

Trade Catalogs

Screws, Nuts, Bolts and Rivets. The Pheoll Manufacturing Co., 5700 Roosevelt Road, Chicago, Ill. The latest catalog of this company contains all the newest additions to the standard line of screws, nuts, bolts, rivets, pins and washers. In addition to the standard lines several lines of special products are listed, with complete data and specifications for each item. The catalog is especially well made, bound in heavy paper covers and with a marginal index that makes it quite easy to locate each item.

Rivetless Chains. The Link-Belt Company, 910 Michigan Ave., Chicago, Ill. Booklet No. 755 just issued by this company contains descriptions and illustrations of drop forged, rivetless chains for conveyors and elevators. Tables of types and sizes with full details of construction, with illustrations, are included.

The Guardian of Good Merchandise. The Wirebound Box Manufacturers Association, 510 No. Dearborn St., Chicago, Ill. A new 48-page booklet contains a wealth of information on shipping methods and was prepared by the association to promote more economical and efficient boxing, crating and shipping practices among American shippers. While it deals largely with the wirebound method of construction, it gives much valuable general information relating to the use of boxes and packages. The book is profusely illustrated with pictures of the manufacture of wood, fibers and finished boxes and many valuable hints are given for packing and shipping merchandise of all kinds.

Taps, Dies, Screw Plates and Reamers. Butterfield & Co., Division (Union Twist Drill Co.), Derby Line, Vermont. Catalog No. 19 which supersedes all previous issues. This book contains a valuable collection of data on the various products manufactured by this company. Most of the information is in the form of tables of prices and sizes, and practically each type of product is illustrated. A separate section in the back of the book is devoted to tables of dimensions, tolerances and formulas. This is a most valuable section.

Motors. Fairbanks, Morse & Co., Chicago, Ill. Bulletin H306 which is mostly a series of illustrations showing the application of Fairbanks-Morse motors on metal-working machines. These motors are shown driving various types of machines in machine tool plants, railroad shops and automotive plants.

Automatic Control of Planers. The Cutler-Hammer Mfg. Co., Milwaukee, Wis. Publication C-14, an eight-page bulletin, dealing with the economy, accuracy and increased production to be effected through the application of automatic controllers to planers direct connected to motors. The booklet also includes a description of the controller and its operating functions.

Boston Gears. Boston Gear Works, Norfolk Downs, Quincy, Mass. Catalog No. 45. This catalog is offered as a convenient reference to the complete line of standardized gears which are carried in stock by this company. It includes many recent additions to the list, and attention is also called to several substantial price reductions. Directions are given for ordering standard gears and for special orders. Each group of styles is given a special department in the catalog, and complete data and specifications are listed, with illlustrations of the gears.

Machinist's, Mill and Railroad Supplies. Charles H. Besly & Co., 118-124 North Clinton St., Chicago, Ill. The 50th anniversary catalog, No. 50, containing over 800 pages, has been issued. The complete line of supplies, machine tools and equipment manufactured and handled by this company are shown. Half-tone engravings and line cuts are used to illustrate the various products listed, and there are tabulations of sizes and descriptions of each unit. Besly specialties are shown, including the grinding machines manufactured in the Besly plant. There are also given a number of useful tables and miscellaneous information, such as sizes, weights and measures, referred to daily in the average plant. This catalog offers a valuable reference and index to buyers and users of mill supplies.

The pages are well printed on 6½x9-in. coated stock and bound in cloth-board orange covers, making this catalog distinctive and attractive. A complete index of twenty-six pages provides for rapid location of references to machines or tools. The catalog is an appropriate commemoration of the fiftieth anniversary of the founding of this company.

Calendar of Local Meetings

American Society of Mechanical Engineers

Birmingham, Ala., May 19. "Processes of Preparation and Commercial Uses of Blast Furnace Slag," C. E. Ireland. G. L. Bentley, secretary, the Ingersoll-Rand Co., 1802 American Trust Building, Birmingham, Ala.

Portland, Ore., June 22 to 25. Pacific Coast Regional Meeting.

Society of Automotive Engineers

Buffalo Section. May 19.

American Society for Steel Treating

Schenectady, N. Y. Spring Section Meeting. May 28, 29 and 30. Hotel Van Curler. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

National Association of Cost Accountants

Buffalo Chapter. May 14. Annual election of officers.

Twin Cities Chapter. May 14. A review of all previous topics of the series. Election of officers.

Cleveland Chapter. May 20. "Retailing-Reaching the Consumer," and "Uniform Costs for the Retailer."

Rochester Chapter. May 20. "Methods of Applying Selling and Administration Expenses to the Product." Prof. Charles Reitell.

Syracuse Chapter. May 20. Subject to be announced. Percy S. Brown, the speaker.

Detroit Chapter. May 21. "Experience in Simplifying the Cost System."

Forthcoming Meetings

American Society of Mechanical Engineers. Spring Meeting. Milwaukee, Wis. May 18, 19, 20 and 21. Calvin W. Rice, secretary, 29 West 39th St., New York City.

United States Chamber of Commerce. Thirteenth annual meeting, Washington, D. C., May 20, 21 and 22.

American Iron & Steel Institute. The 27th general meeting of American Iron & Steel Institute will be held May 22 at Hotel Commodore, New York.

Division V of the American Railway Association. Business meeting June 16 to 18, Chicago. V. R. Hawthorne, 431 S. Dearborn St., Chicago, Ill.

Society of Automotive Engineers. Summer Meeting. Greenbrier Hotel, White Sulphur Springs, W. Va., June 16, 17, 18 and 19. C. F. Clarkson, secretary, 29 West 39th St., New York City.

American Society for Testing Materials. Twenty-eighth annual meeting. Chalfonte-Haddon Hall Hotel, Atlantic City, N. J., June 22, 23, 24, 25 and 26. C. L. Warwick, secretary-treasurer, 1315 Spruce St., Philadelphia, Pa.

National Foreign Trade Council. Annual Convention. Seattle, Wash., June 24, 25 and 26. O. K. Davis, secretary, India House, Hanover Square, New York City.

American Railway Tool Foremen's Association. Annual convention, Hotel Sherman, Chicago, Ill., in August. G. G. Macina, C. M. & St. P. Ry., 1402 Calumet Ave., Chicago, Ill.

International Railway General Foremen's Association. Annual convention, Hotel Sherman, Chicago, Sept. 8, 9, 10 and 11. William Hall, secretary and treasurer, 1061 W. Wabash St., Winona, Minn.

New Haven Branch of the American Society of Mechanical Engineers. Fifth annual machine tool exhibition. Sept. 8 to 11. Mason Laboratory. H. R. Westcott, chairman.

American Society for Steel Treating. Annual Convention and National Steel Exposition. Public Auditorium, Cleveland, Ohio. Week of Sept. 14. W. H. Eisenman, Secretary, 4600 Prospect Ave., Cleveland, Ohio.

The Weekly Price Guide

Rise and Fall of the Market

Iron and Steel—Dullness prevails in the iron market; buying is confined to small lots; that prices will go a little lower is not at all improbable. Steel demand dropped considerably during the past week, particularly with regard to requirements in the railroad and oil industries. Price weakness marks several of the major steel items, such as, scrap, sheets, plates, shapes, and bars. The last three mentioned, are now selling at a mill base of $2 per 100 lb. Pittsburgh; the frequently repeated quotation of $2.10 is regarded as being purely nominal.

Non-Ferrous Materials—Antimony advanced 4½c. per lb. between May 1 and May 8, owing to scarcity of reserve stocks. Copper and lead are both at their respective price levels of May 1. Tin is quiet, here and abroad; price is ⅛c. per lb. higher than a week ago. Zinc market reported easier with prices tending downward.

(All prices as of May 8)

IRON AND STEEL

PIG IRON—Per gross ton, f.o.b.:

CINCINNATI	
No. 2 Southern	$24.05
Northern Basic	23.27
Southern Ohio No. 2	23.27
NEW YORK—Tidewater Delivery	
Southern No. 2 (silicon 2.25@2.75)	27.37
BIRMINGHAM	
No. 2 Foundry	22.00
PHILADELPHIA	
Eastern Pa., No. 2x (silicon 2.25@2.75)	24.26
Virginia No. 2	29.17
Basic	23.26
Grey Forge	23.75
CHICAGO	
No. 2 Foundry local	23.00
No. 2 Foundry, Southern (silicon 2.25@2.75)	26.55
PITTSBURGH, including freight charge ($1.76) from Valley	
No. 2 Foundry	23.77
Basic	23.77
Bessemer	23.77

IRON MACHINERY CASTINGS—Cost in cents per lb. of 100 flywheels, 6-in. face x 24-in. dia., hub not cored, good quality gray iron, weight 275 lb.:

Detroit	4.75
Cleveland	4.75@5.00
Cincinnati	5.00@7.50
New York	5.00@5.50
Chicago	5.25@5.75

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the mill base in large lots.

Blue Annealed	Pittsburgh Mill Base	New York	Cleveland	Chicago
No. 10	2.50@2.70	3.89	3.35	3.80
No. 12	2.55@2.75	3.94	3.40	3.85
No. 14	2.60@2.80	3.99	3.45	3.95
No. 16	2.70@2.90	4.09	3.55	4.15
Black				
Nos. 17 to 21	3.30@3.40	4.40	4.05	4.30
Nos. 22 to 24	3.35@3.45	4.45	4.10	4.35
Nos. 25 and 26	3.40@3.50	4.50	4.15	4.40
No. 28	3.50@3.60	4.60	4.25	4.50
Galvanized				
Nos. 10 and 11	3.40@3.50	4.60	...	4.50
Nos. 12 to 14	3.50@3.60	4.70	....	4.60
No. 16	3.65@3.75	4.85	....	....
Nos. 17 to 21	3.80@3.90	5.00	....	4.90
Nos. 22 to 24	3.95@4.05	5.15	4.90	5.05
No. 26	4.10@4.20	5.30	5.05	5.20
No. 28	4.40@4.50	5.60	5.35	5.50

WROUGHT PIPE (Welded)—Warehouse discounts are as follows:

	New York Black	New York Galv.	Cleveland Black	Cleveland Galv.	Chicago Black	Chicago Galv.
1 to 3 in. steel butt welded	53%	39%	55½%	43½%	59½%	48%
3½ to 6 in. steel lap welded	48%	35%	53½%	40½%	56½%	45%

Malleable fittings: Classes B and C, banded, from New York stock sell at list plus 4%, less 5%; class A, plus 23%. Cast iron, standard sizes, 36% off.

Size, Inches	List Price per Foot	Diameters Inches External	Diameters Inches Internal	Thickness Inches
1	$0.17	1.315	1.049	.133
1¼	.23	1.66	1.38	.14
1½	.27½	1.9	1.61	.145
2	.37	2.375	2.067	.154
2½	.58½	2.875	2.469	.203
3	.76½	3.5	3.068	.216
3½	.92	4.0	3.548	.226
4	1.09	4.5	4.026	.237
4½	1.27	5.0	4.506	.247
5	1.48	5.563	5.047	.258
6	1.92	6.625	6.065	.28

SEAMLESS STEEL TUBING—Following base discounts are on 20 gauge or .035-in., round, cold-drawn tubing, ¼-in. to 1-in., O.D., weighing 0.17 lb. to 0.36 lb. per ft. Cutting charge per 100 cuts, $1.50 to $1.58:

O.D. Inches	List Price per ft.	Differential Discount	O.D. Inches	List Price per ft.	Differential Discount
¼	$0.09	50%	¾	$0.16	35%
⅜	.11	45%	1	.18	31%
½	.14	40%			

NOTE—The discounts are to be lowered by the following differentials in the case of regular .10-.20 carbon: 25,000 ft. or over, 83; 15,000 to 25,000 ft., 82; 5,000 to 15,000 ft., 81; 1,000 to 5,000 ft., 80; less than 1,000 ft., 79.

MISCELLANEOUS—Warehouse prices in cents per pound in 100-lb. lots:

	New York	Cleveland	Chicago
Open hearth spring steel (base)	4.50	6.00	4.20
Spring steel (light) (base)	7.00	6.00	6.00
Coppered Bessemer rods (base)	6.85	8.00	7.20
Hoop steel	4.49	3.85	4.15
Cold rolled strip steel	7.00	8.25	7.85
Floor plates	5.55	5.60	5.50
Cold drawn shafting or screw	4.15	4.00	3.80
Cold drawn flats, squares	4.65	4.50	4.30
Structural shapes (base)	3.34	3.20	3.10
Soft steel bars (base)	3.24	3.10	3.00
Soft steel bar shapes (base)	3.24	3.11	3.00
Soft steel bands (base)	3.99	3.20	3.65
Tank plates (base)	3.34	3.40	3.10
Bar iron (3.00 at mill)	3.24	3.21	3.00
Drill rod (from list)	60%	55%	50%

Electric welding wire, New York, ⅛, 8.25c.; ¼, 7.85c.; ⅝ to ½, 7.35c. per lb. Chicago, ⅛, 8.85c.; ⅜, 7¼c.; ½, 7.95c. per lb.

METALS

Current Prices in Cents Per Pound

Copper, electrolytic (up to carlots), New York			14.00
Tin, 5-ton lots, New York			54.62½
Lead (up to carlots), St. Louis	7.50	New York	8.12½
Zinc (up to carlots), St. Louis	6.90	New York	7.75

	New York	Cleveland	Chicago
Antimony (Chinese), ton spot	16.00	16.00	14.00
Copper sheets, base	21.75	21.75	22.00
Copper wire, base	19.25	21.25	20.00
Copper bars, base	20.87½	21.50	22.50
Copper tubing, base	23.75	24.25	24.00
Brass sheets, base	18.12½	18.62½	18.37½
Brass tubing, base	22.75	25.25	26.00
Brass rods, base	15.87½	16.37½	18.37½
Brass wire, base	18.62½	20.12½	20.00

Shop Materials and Supplies

METALS—Continued

	New York	Cleveland	Chicago
Aluminium ingots, 98 to 99%, 1–15 ton lots	28.00	28.00	27.00
Zinc sheets (casks)	11.00	11.25	11.37
Solder (½ and ½), (case lots)	39.50	36.50	.....
Babbitt metal (83% tin)	60.00	65.00	50.00
Babbitt metal (35% tin)	28.00	20.50	28.00
Nickel (ingots) f.o.b. refinery	31.00	.....	.....
Nickel (electrolytic) f.o.b. refinery	38.00	.....	.....
Nickel (shot) f.o.b. refinery	32.00	.....	.....

SPECIAL NICKEL AND ALLOYS—Price in cents per lb., f.o.b. Huntington, W. Va.:

Hot rolled nickel sheet (base)	52.00
Cold rolled nickel sheet (base)	60.00
Hot rolled rods, Grade "A" (base)	50.00
Cold drawn rods, Grade "A" (base)	58.00
Manganese nickel hot rolled rods "E"—low manganese (base)	54.00
Manganese nickel hot rolled rods "D"—high manganese (base)	57.00

Base price of Monel Metal in cents per lb., f.o.b. Huntington, W. Va.:

Shot	32.00	Hot rolled rods (base)	40.00
Blocks	32.00	Cold drawn rods (base)	48.00
Ingots	38.00	Hot rolled sheets (base)	42.00
Cold rolled sheets (base)			50.00

OLD METALS—Dealers' purchasing prices in cents per pound:

	New York	Cleveland	Chicago
Crucible heavy copper	11.00@11.50	11.25	10.25
Copper, heavy, and wire	10.75@11.00	11.00	10.25
Copper, light, and bottoms	9.25@ 9.75	9.00	9.00
Heavy lead	6.25@ 6.50	6.25	6.50@6.75
Tea lead	5.25@ 5.50	3.75	5.50@5.75
Brass, heavy, yellow	6.75@ 7.25	6.50	7.00
Brass, heavy, red	8.50@ 8.75	8.75	8.00
Brass, light	5.75@ 6.00	5.50	6.00
No. 1 yellow rod turnings	7.25@ 7.50	7.00	7.75
Zinc	4.00@ 4.25	3.75	4.00

TIN PLATES—American Charcoal—Bright—Per box.

		New York	Cleveland	Chicago
"AAA" Grade:				
IC,	14x20	$11.75	$11.45	$11.00
"A" Grade:				
IC,	14x20	9.50	9.40	8.50
	Coke Plates—Primes.			
100-lb.,	14x20	6.50	6.10	6.50
	Terne Plates—Small lots, 8-lb. Coating			
IC,	14x20	7.25	6.80@6.90	6.75

MISCELLANEOUS

	New York	Cleveland	Chicago
Cotton waste, white, per lb.	$0.15@0.22	$0.19	$0.14
Cotton waste, colored, per lb.	.10@ .15½	.18	.09½
Wiping cloths, 13½x13½, per lb	.17	36.00 per M	.11*
Wiping cloths, 13½x20½, per lb.	.....	45.00 per M	.11*
Sal soda, per 100 lb. keg	2.25	2.25	2.00
Roll sulphur, per 100 lb. keg	3.60	3.75	2.85
Linseed oil, per gal., 5 bbl. lots	1.07	1.21	1.26
Lard cutting oil, 25% lard, per gal.	.60	.50	.32
Machine lubricant, medium-bodied (50 gal. wooden bbl.), per gal.	.33	.35	.21
Belting—Present discounts from list in fair quantities (½ doz. rolls).			
Leather—List price, 24c. per lin. ft. per inch of width for single ply.			
Medium grade	30–10%	30–10%	30–10%
Heavy grade	20–5%	20–5%	20–5%
Rubber transmission, 6-in., 6 ply, $1.83 per lin. ft.			
First grade	50–5%	50–10%	60%
Second grade	50–10–5%	60–5%	65%

*White, at washery.

Comparative Warehouse Prices

New York	Unit	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars	per lb.	$0.0324	$0.0324	$0.0349
Cold finished shafting	per lb.	.0415	.0415	.044
Brass rods	per lb.	.1587½	.1612½	.15
Solder (½ and ½)	per lb.	.39½	.36	.37
Cotton waste	per lb.	.15@.22	.15@.22	14@21
Washers, cast iron (½ in.)	per 100 lb.	7.00	7.00	6.50
Emery, disks, cloth, No. 1, 6 in. dia.	per 100	3.38	3.38	3.38
Lard cutting oil	per gal.	.60	.60	.55
Machine oil	per gal.	.33	.33	.29
Belting, leather, medium	off list	30–10%	40–2½%	40–2½%
Machine bolts up to 1x30 in.	off list	40%	40%	45%

MISCELLANEOUS—Continued

	New York	Cleveland	Chicago
Abrasive materials—In sheets 9x11 in., No. 1 grade, per ream of 480 sheets:			
Flint paper	$4.86	$5.84	$5.00
Emery paper	10.71	11.00	11.00
Emery cloth	28.00	31.12	32.75
Emery disks, 6 in. dia., No. 1 grade, per 100:			
Paper	1.49	1.24	1.50
Cloth	3.38	2.67	3.55
Fire clay, per 100 lb. bag		.65	.75
Coke, prompt furnace, Connellsville	per net ton		3.25@3.75
Coke, prompt foundry, Connellsville	per net ton		4.00@4.50
White lead, dry or in oil	100 lb. kegs	New York, 15.75	
Red lead, dry	100 lb. kegs	New York, 15.75	
Red lead, in oil	100 lb. kegs	New York, 17.25	

SHOP SUPPLIES

Machine bolts, ¼x1½-in., per 100, $1.70. Discount at New York warehouses on all sizes up to 1x30-in., 40%; 1½ and 1¼x3-in. up to 12-in., 15%; with cold punched hex. nuts up to 1-in. dia. (plus std. extra of 10%) 30%; with hot pressed hex. nuts up to 1x30-in. (plus std. extra of 10%) 35%. Machine bolts, up to 1x30-in., with cold punched and hot-pressed hex. nuts, also button head bolts with hex. nuts are $3.50 per 100 lb. at Cleveland.

Carriage bolts, ¼x1½-in., per 100, $1.00. Discount on all sizes up to 1x30-in., 30%.

Coach and lag screws, 1½x$\frac{7}{16}$in., $2.25 per 100, less 40%.

Tap bolts, 1½x¼-in., $1.00 per 100. List plus 35% at New York warehouses; with hex. heads, $4.65 per 100 lb. net at Chicago.

Bolt ends, 1x12-in., 10c. per lb., less 40%.

Nuts, semi-finished, ½x¼-in., 2c. each. Discount 70% for $\frac{9}{16}$-in. and smaller and 65% for ⅝-in. and larger.
Case hardened ½x¼-in., 6c. each, less 50%.

Rivets, button heads, ⅜-in., ½-in., 1-in. diam. x2$\frac{1}{16}$-in. to 4$\frac{1}{16}$-in., $5.00* per 100 lb. at New York warehouses; cone heads, same sizes, $5.20* per 100 lb. Rivets, $\frac{1}{16}$x1-in. and longer, 19c. per lb., less 50%. Same discount for tinned. EXTRA per 100 lb. for 1¼ to 2-in. long, all diameters, 25c.; ⅝-in. dia., 35c.; ½-in. dia., 75c.; 1-in. long and shorter, 75c., longer than 5-in., 50c.; less than 200 lb., 50c.; countersunk heads, 45c.

Washers, cast iron, ½-in., $7.00* per 100 lb. at New York warehouses; ⅝-in., $6.00* per 100 lb.

*For immediate delivery from warehouse.

Machine Requirements and Industrial Construction

Machine Tools and Equipment Wanted

Ill., Freeport—Holmes Mfg. Co., 216 West Spring St., (millwork)—woodworking machinery.

Ill., Peoria — Hart Oil Burner Co. — 10 turret lathes, 6 drilling machines, 7 engine lathes, 2 milling machines.

Mass., Attleboro — School Committee — manuel training equipment, including woodworking machinery for new high school addition.

Mass., Cambridge (Boston, P. O.)—B. Goldfine, 11 Beacon St., Boston—equipment for service and repair garage at Massachusetts Ave. and Roseland St., here.

Mass., Dorchester (Boston P. O.)—C. J. Desmond, 5 Mountain Ave.—tools and equipment for repair and service garage.

Mass., East Boston (Boston, P. O.)—I. Inzerra, 166-168 Paris St.—miscellaneous tools and equipment for large repair and service garage.

Mass., Jamaica Plain (Boston P. O.)—C. A. Peterson, 63 Greene St. — miscellaneous tools and equipment for repair and service garage.

Mich., Detroit — H. E. Schultz, 14432 Young Ave.—woodworking machine.

N. Y., Buffalo—W. N. Denler, Clarence St. and Kensington Ave., (sheet metal shop)—tools and equipment for shop.

N. Y., Buffalo—G. Griffin, 443 Ellicott St., (plating and polishing metals)—small lathe.

N. C., High Point—Shelton Woodworking Machinery Co., T. G. Shelton, Secy., 154 South Main St.—equipment for new plant.

O., Columbus—Flint Motor Co., 676 North High St. W. A. Mitchell, Mgr.—18 in. lathe, drill press, and other equipment for new service station.

O., Columbus—Ohio Auto Spring Co., 50 South Lazell St., S. Hooper, Gen. Mgr. (mfg. auto springs, etc.)—hydraulic press, drill press, shear machine, punch machine and furnace blower.

Pa., Latrobe—Vulcan Mold & Iron Co.—locomotive crane.

Pa., Phila.—General Electric Co., Witherspoon Bldg.—cranes for new plant additions, on Elwood Ave.

Pa., Pittsburgh—H. C. Frick Coke Co., Carnegie Bldg.—lathe, drill press, pipe machine.

Wash., Vancouver — Vancouver Lumber Co., E. J. Young, 1 West Main St., Madison, Wis.—machinery for new lumber mill, here.

Wis., Milwaukee—Central Bd. of Purchases, City Hall, J. Nicholson, Pur. Agt — large planer for North Point pumping station.

Opportunities for Future Business

Ark., Fayetteville—Phillips Box Co., 20 East Center St., E. M. Ratcliffe, Secy., will build a plant addition for the manufacture of boxes on East Center St., by day labor. Estimated cost $75,000. Private plans.

Calif., Emeryville—Pacific Gas & Electric Co., 445 Sutter St., San Francisco, awarded contract for the construction of a foundry machine shop, etc. Estimated cost $149,500. Noted Apr. 16.

Calif., Glendale—Packer Auto Co., 245 South Brand Blvd., is having plans prepared for the construction of a 125 x 150 ft. garage, on Central Ave. A. F. Priest, Fay Bldg., Los Angeles, Archt.

Calif., Los Angeles—Bd. of Educ. will soon award contract for the construction of a 1 story shop for Roosevelt High School.

Calif., Salinas—Coast Valleys Gas & Electric Corp., awarded contract for the construction of a garage, machine shop, etc. Estimated cost $12,500.

Calif., San Francisco — Philadelphia Storage Battery Co., 37 Spear St., plans the construction of a 2 story, 60 x 150 ft. factory at Fremont St. Estimated cost $45,000. Ashley & Evers, 58 Sutter St., Archts.

Calif., Van Nuys—Robert-Morton Organ Co., has had plans prepared for the construction of a 1 story factory. Estimated cost $125,000. Private plans.

Calif., Wasco—Wasco High School District, awarded contract for the construction of manual training shops. Estimated cost $45,250.

Conn., Southington—Clark Brothers' Bolt Co., Milldale, plans the construction of a 2 story, 46 x 125 ft. factory building.

Ga., Albany — The Littiston Harvester Co., plans the construction of foundries and shops for the manufacture of harvester machines and other farm machinery to replace fire loss. Estimated cost $20,000.

Ill., Chicago — Leichenko & Esser, 38 South Dearborn St., Archts., are receiving bids for the construction of a 2 story, 125 x 250 ft. auto sales and service building on Milwaukee St., for I. B. Tow, 133 West Washington St. Estimated cost $300,000.

Me., Waterville—Maine Central R.R., 222 St. John St., Portland, awarded contract for the construction of a 100 x 100 ft. car repair shop, here. Estimated cost $40,000. Noted May 7.

Md., Baltimore — Mack International Truck Corp., 46 East Ellis St., Atlanta, Ga., awarded contract for the construction of a sales and service building, here. Estimated cost $200,000.

Mass., Boston—S. Smoriak, 343 Harrison Ave., will build a 40 x 200 ft. repair and service garage at 421 Harrison Ave., by day labor. Estimated cost $40,000. S. S. Levy, 35 Court St., Archt.

Mass., Brighton (Boston, P. O.)—Electric Storage Battery Co., 720 Beacon St., Boston, is receiving bids for the construction of a 1 and 2 story, 135 x 274 ft., plant and office building on Ashford St., here. Estimated cost $100,000. Bigelow & Wadsworth, 3 Hamilton Pl., Boston, Archts. Noted April 23.

Mass., Chelsea (Boston, P. O.)—Francis & Badfer Motor Co., 279 Broadway, plans the construction of a repair and service garage, at Broadway and Carson Sts. Estimated cost $50,000. Architect's name withheld.

Mass., Danvers—Fire Department is having plans revised for the construction of a 2½ story, 35 x 45 ft. and 14 x 15 ft. fire station and machine repair shop. Former bids rejected. Stebbins & Watkins, 164 Federal St., Boston, Archts. Noted Apr. 2.

Mass., Dorchester (Boston P. O.)—J. Waldman, 38 Hobson St., Brighton, awarded contract for the construction of a 150 x 160 ft. repair and service garage on Livingstone St., here. Estimated cost $100,000. Noted Apr. 23.

Mass., Holyoke—F. H. Franz, c/o Franz & Bond, Archts., 189 High St., awarded contract for the construction of a repair and service garage at 186-188 Maple St. Estimated cost $50,000.

Mass., Medford (Boston P. O.)—Boston Elevated Railway Co., Park Sq. Bldg., Boston, is taking bids for the construction of a 112 x 120 ft. repair and service garage, on Salem St., here. Estimated cost $120,000. Private plans. Noted Apr. 23.

Mass., Newton (Boston, P. O.)—A. T. Stuart, c/o L. Hamburger, 8 Winter St., Boston, awarded contract for the construction of a 1 story, 145 x 150 ft. repair and service garage at Washington and Hovey Sts. Estimated cost $75,000.

Mass., Quincy—L. Grossman & Sons, 22 School St., plans the construction of a 2 story, 100 x 300 ft. plant for the manufacture of mill and builders supplies at Edwards Meadows. Estimated cost $100,000.

Mich., Pontiac — Fisher Body Corp., awarded contract for the construction of a 2 story 126 x 154 ft. auto body plant on Baldwin Ave. Estimated cost $175,000.

Miss., Gulfport—Salmen Inc., will build a 1 story, 100 x 100 ft. saw mill and lumber shed, by day labor. Estimated cost $30,000.

Mo., Kansas City—Dunlap Realty Co., 301 New York Life Bldg., will soon award contract for the construction of 3 story, 60 x 109 ft. garage, etc., on 9th and Delaware Sts. Estimated cost $150,000. Hoit, Price & Barnes, 800 Davidson Bldg., Archts.

Mo., Kennett—A. B. Smith Lumber Co., plans the construction of a large lumber plant to replace fire loss. Estimated cost $225,000.

Mo., St. Louis — Multiplex Faucet Co., 22nd and Cass Ave., is receiving bids for the construction of a 2 story, 80 x 200 ft. faucet factory on Duncan Ave. Estimated cost $75,000. W. P. McMahon, Buder Bldg., Archt.

O., Canton—Peerless Auto. Sales Co., 421 Cleveland Ave. N. W. plans the construction of a 2 story, 100 x 150 ft. garage on Walnut and Third Sts. N. E. Estimated cost $150,000.

O., Cleveland—The Morrean Co., H. A. Kelly, Secy., plans to rebuild 3 story plant, for the manufacture of lighting fixtures. Estimated cost $40,000. Architect not selected.

O., Cleveland—Mueller Electric Co., c/o R. S. Mueller, 1583 East 31st St., has had plans prepared for the construction of a factory addition. Estimated cost $40,000. G. S. Rider & Co., Century Bldg., Archt.

N. C., High Point—Shelton Woodworking Machinery Co., T. G. Shelton, Secy., 154 South Main St., plans the construction of a new plant for rebuilding woodworking machinery.

Pa., Johnstown—Cambria Steel Co., E. G. Grace, Pres., plans to expend $3,000,000 for improvements to the Franklin Works. Plans include the construction of 70 coke ovens, cost $2,500,000, and a car shop department, cost $500,000.

Pa., Pittsburgh—Pierpont Motor Co., 5200 Pennsylvania Ave., awarded contract for the construction of a 5-story, 130 x 196 ft. sales and service station, at Baum Blvd. and Morewood St. Estimated cost, $300,000.

Pa., Pittsburgh—Standard Sanitary Mfg. Co., Bessemer Bldg., awarded contract for the construction of a 5 story pipe shop and warehouse at Manchester Blvd. and South Ave.

Pa., Pittsburgh—Whitehill Gleason Motor Co., is having plans prepared for the construction of a 3-story, 150 x 250 ft. repair and sales building on South Euclid St. Estimated cost $150,000. M. Nidlinger, Empire Bldg., Archt.

Tex., Dallas—Sanger Bros. Dry Goods Co., Main and Lamor Sts., is having plans prepared for the construction of a 5-story, 100 x 100 ft. garage at Elm and Austin Sts. Estimated cost $150,000. J. A. Pitzinger, 807 S. W. Life Bldg., Archt.

Tex., Houston—M. M. Graves awarded contract for the construction of a 2-story, 125 x 175 ft. garage at McKinney and Caroline Sts. Estimated cost, $150,000.

Wis., Green Bay—Straubel Machine Co., 624 Willow St., awarded contract for the construction of a 78 x 85 ft. machine shop addition. Estimated cost $12,000.

Ont., North Bay—Temiskaming & Northern Ontario Railway Commission, G. W. Lee, Chmn., is receiving bids for the construction of additional shops. Estimated cost $100,000. S. B. Clement, Ch. Engr.